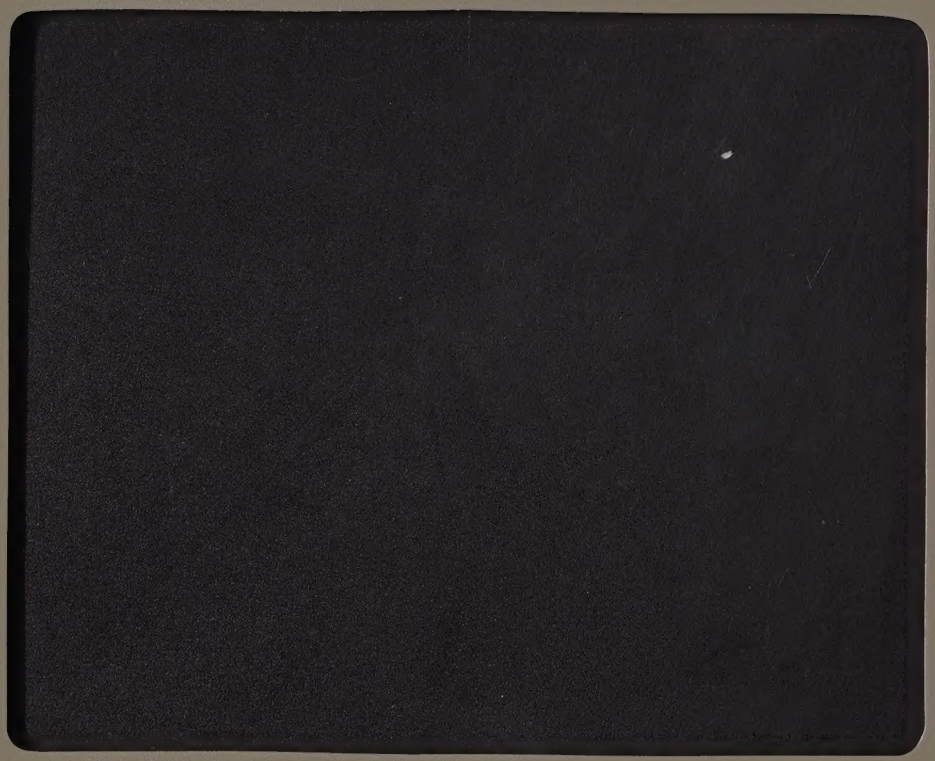
FLUKE®



NOTE

This manual documents the Model 8800A and its assemblies at the revision levels shown in Appendix 7A. If your instrument contains assemblies with different revision letters, it will be necessary for you to either update or backdate this manual. Refer to the supplemental change errata sheet for newer assemblies, or to the backdating sheet in Appendix 7A for older assemblies.

8800A
Digital Multimeter

Instruction Manual

P/N 369405
November 1974
Rev. 4 8/80

FLUKE®

WARRANTY

Notwithstanding any provision of any agreement the following warranty is exclusive:

The JOHN FLUKE MFG. CO., INC., warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of 1-year from date of purchase. This warranty extends only to the original purchaser. This warranty shall not apply to fuses, disposable batteries (rechargeable type batteries are warranted for 90-days), or any product or parts which have been subject to misuse, neglect, accident, or abnormal conditions of operations.

In the event of failure of a product covered by this warranty, John Fluke Mfg. Co., Inc., will repair and calibrate an instrument returned to an authorized Service Facility within 1 year of the original purchase; provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within 1 year of the original purchase, said repairs or replacement will be made without charge. If the failure has been caused by misuse, neglect, accident, or abnormal conditions of operations, repairs will be billed at a nominal cost. In such case, an estimate will be submitted before work is started, if requested.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS, OR ADEQUACY FOR ANY PARTICULAR PURPOSE OR USE. JOHN FLUKE MFG. CO., INC., SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT, OR OTHERWISE.

If any failure occurs, the following steps should be taken:

1. Notify the JOHN FLUKE MFG. CO., INC., or nearest Service facility, giving full details of the difficulty, and include the model number, type number, and serial number. On receipt of this information, service data, or shipping instructions will be forwarded to you.

2. On receipt of the shipping instructions, forward the instrument, transportation prepaid. Repairs will be made at the Service Facility and the instrument returned, transportation prepaid.

SHIPPING TO MANUFACTURER FOR REPAIR OR ADJUSTMENT

All shipments of JOHN FLUKE MFG. CO., INC., instruments should be made via United Parcel Service or "Best Way" prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER

The instrument should be thoroughly inspected immediately upon original delivery to purchaser. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument is damaged in any way, a claim should be filed with the carrier immediately. (To obtain a quotation to repair shipment damage, contact the nearest Fluke Technical Center.) Final claim and negotiations with the carrier must be completed by the customer.

The JOHN FLUKE MFG. CO., INC, will be happy to answer all applications or use questions, which will enhance your use of this instrument. Please address your requests or correspondence to: JOHN FLUKE MFG. CO., INC., P.O. BOX 43210, MOUNTLAKE TERRACE, WASHINGTON 98043, ATTN: Sales Dept. For European Customers: Fluke (Holland) B.V., P.O. Box 5053, 5004 EB, Tilburg, The Netherlands.

*For European customers, Air Freight prepaid.

John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, Washington 98043

Rev. 4/80

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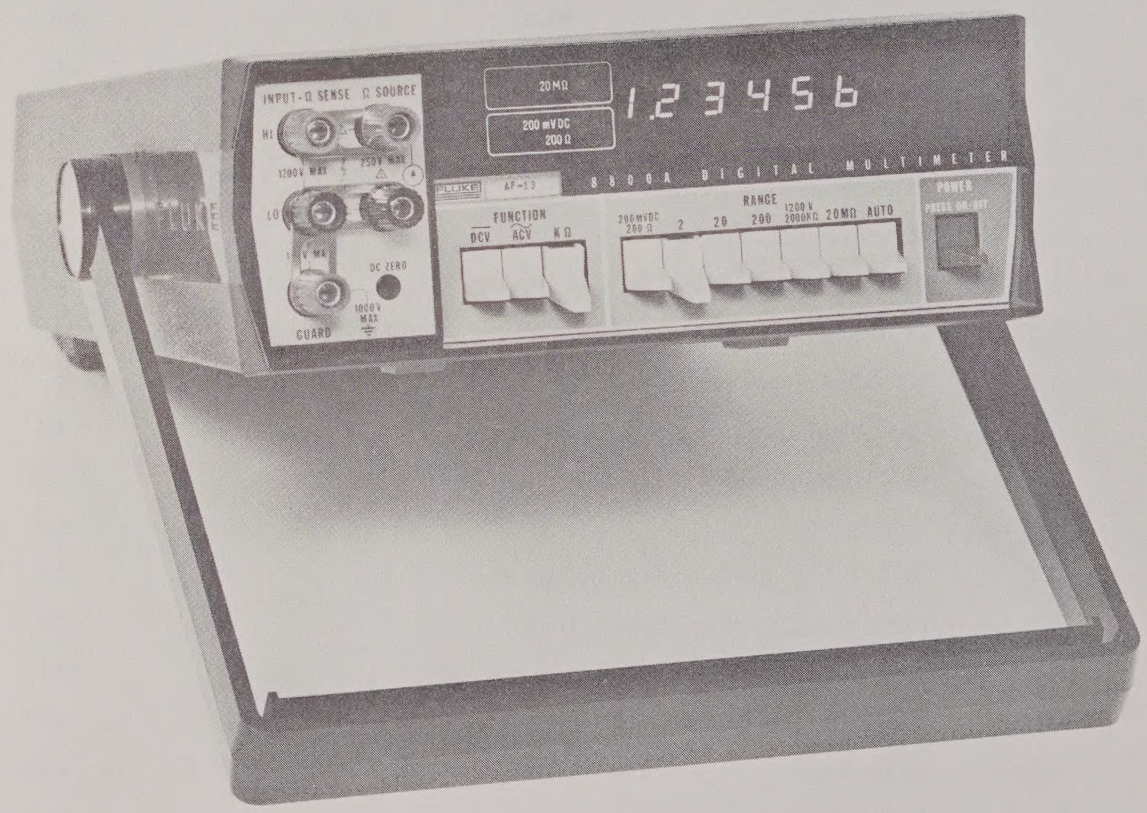


8800A DIGITAL MULTIMETER

Section 1
Introduction & Specifications

1-1. INTRODUCTION

1-2. The Model 8800A Digital Multimeter is a 5½ digit instrument providing automatic or manual ranging for five dc voltage ranges, four ac voltage ranges and six resistance ranges. The dual slope method of analog-to-digital (A/D) conversion, coupled with self zeroing, eliminates the display uncertainties caused by inherent A/D zero offsets. A single, digital integrated circuit uses the A/D output signal to produce the proper digit, decimal point and polarity information for the display.

1-3. The piano-key type control switches on the front panel make the light weight unit easy to operate. The unit's carrying handle also doubles as a tilt stand to provide convenient viewing angles for bench use. A flashing display of 188888, used for indicating an input overrange condition, also provides a convenient way of checking each digit for proper segment illumination.

1-4. OPTIONS

1-5. The basic 8800A multimeter can be equipped at the factory with a Data Output Unit (DOU) option. The multimeter with the DOU option installed, designated the 8800A-02, allows the unit to supply the display information to data acquisition systems or digital printer equipment.

1-6. ACCESSORIES

1-7. Accessories available for use with the 8800A Digital Multimeter are listed in Table 1-1. Accessory descriptions and specifications are given in Section 6 of this manual.

Table 1-1. 8800A ACCESSORIES

ACCESSORY MODEL NO.	DESCRIPTION
MOO-200-625	Rack Mount Kit
A90	Current Shunt
Y8100	DC/AC Current Probe
Y8133	Test Lead Set
Y8140	Test Lead Set
Y9108	BNC Jack-to-Banana Plug Adapter
80F-15	High Voltage Probe
80K-40	High Voltage Probe
80J-10	Current Shunt
80T-150	Temperature Probe
81RF	High Frequency Probe
82RF	High Frequency Probe

1-8. SPECIFICATIONS

1-9. Specifications for the Model 8800A are presented in Table 1-2. Specifications for the -02 Option are given in Section 6 of the manual.

Table 1-2. SPECIFICATIONS

DC VOLTAGE

Ranges	200 mV, 2V, 20V, 200V, 1200V
Accuracy:	
(24 Hr. 23°C ±1°C)	
200 mV range	±(0.008% of input + 0.0025% of range)
2V - 200V range	±(0.005% of input + 0.001% of range)
1200V range	±(0.005% of input + 0.002% of range)
(90 days 18°C - 28°C)	
200 mV range	±(0.01% of input + 0.005% of range)
2V - 200V range	±(0.01% of input + 0.0015% of range)
1200V range	±(0.01% of input + 0.003% of range)
Temperature Coefficient: (0°C - 18°C, 28°C to 50°C)	
200 mV range	±(0.0007% of input + 0.0013% of range)/°C
2V range	±(0.0007% of input + 0.0003% of range)/°C
20V - 200V range	±(0.0007% of input + 0.0002% of range)/°C
1200V range	±(0.0007% of input + 0.0003% of range)/°C
DC Input Resistance	
200 mV - 20V range	⩾ 1000 megohms
200V - 1200V range	10 megohms
Normal Mode Noise Rejection	⩾ 60 db @ 50 Hz and 60 Hz
Common Mode Noise Rejection	⩾ 120 db @ dc to 60 Hz (with 1kΩ in either lead)
Resolution	1 μV on 200 mV range
Ranging	Full autoranging or manual ranging
Polarity	Automatic bipolar, + or — display
Overload Protection	200V, 1200V range; ±1200V dc, 1700V, peak ac
	200 mV - 20V range; ±1000V dc, 1400V, peak ac
Offset Current (at 23°C)	Less than 15 pA on any range. Temperature coefficient of ±5 pA/°C
Zero Stability	Better than 10 μV for 90 days after one hour warmup
Response Time to Rated Accuracy within Range	1 second maximum to displayed input

AC VOLTAGE

Ranges	2V, 20V, 200V, 1200V
Accuracy:	
2V - 200V ranges (100% to .1% of range)	
(24 Hour, 23°C ±1°C)	
100 Hz - 10 kHz	±(0.05% of input + 0.005% of range)
50 Hz - 100 Hz, 10 kHz - 20 kHz	±(0.1% of input + 0.01% of range)
30 Hz - 50 Hz, 20 kHz - 100 kHz	±(1.0% of input + 0.03% of range)

Table 1-2. SPECIFICATIONS

(90 days 18°C – 28°C)	
100 Hz - 10 kHz	±(0.1% of input + 0.005% of range)
50 Hz - 100 Hz, 10 kHz - 20 kHz	±(0.25% of input + 0.01% of range)
30 Hz - 50 Hz, 20 kHz - 100 kHz	±(1.0% of input + 0.03% of range)
1200V range (100% to .1% of range)	
(90 days 18°C - 28°C)	
(1V to 500V input)	
100 Hz - 10 kHz	±(0.15% of input + 0.01% of range)
30 Hz - 100 Hz, 10 kHz - 20 kHz	±(0.25% of input + 0.02% of range)
(500V to 1200V input)	
100 Hz - 10 kHz	±(0.3% of input + 0.01% of range)
30 Hz - 100 Hz, 10 kHz - 20 kHz	±(0.5% of input + 0.02% of range)
20 kHz maximum response on 1200V range	
Temperature Coefficient:	
(0°C - 18°C, 28°C - 50°C)	±(0.008% of input +0.001% of range)/°C, 2V - 200V range ±(0.008% of input +0.002% of range)/°C, 1200V range
Input Impedance	2 megohms shunted by less than 100 pF
Response Time to Rated Accuracy within Range	1.5 second maximum to displayed input
Ranging	Full autoranging or manual ranging
Overload Protection	1200V rms maximum, not to exceed 2 x 10^7 volt hertz product. 20 kHz maximum on 1200V range.
Resolution	10 μV on 2V range
OHMS	
Ranges	200Ω, 2 kΩ, 20 kΩ, 200 kΩ, 2000 kΩ, 20 MΩ
Resolution	1 mΩ on 200 ohm range
Configuration	Four-terminal measurement on all ranges
Ranging	Full autoranging or manual ranging
Accuracy:	
(24 Hr, 23°C ±1°C)	
200Ω range	±(0.01% of input + 0.0025% of range)
2 kΩ - 200 kΩ range	±(0.008% of input + 0.001% of range)
2000 kΩ range	±(0.02% of input + 0.001% of range)
20 MΩ	±(0.05% of input + 0.001% of range)
(90 day, 18°C - 28°C)	
200Ω range	±(0.02% of input + 0.005% of range)
2 kΩ - 200 kΩ range	±(0.01% of input + 0.0015% of range)
2000 kΩ range	±(0.05% of input + 0.0015% of range)
20 MΩ range	±(0.2% of input + 0.0015% of range)
Temperature Coefficient:	
200Ω range	±(0.001% of input + 0.0013% of range)/°C
2 kΩ - 200 kΩ range	±(0.001% of input + 0.0003% of range)/°C
2000 kΩ range	±(0.005% of input + 0.0003% of range)/°C
20 MΩ range	±(0.02% of input + 0.0003% of range)/°C

Table 1-2. SPECIFICATIONS

Maximum Current Through Unknown						
Range	200Ω	2 kΩ	20 kΩ	200 kΩ	2000 kΩ	20 MΩ
Current	1 mA	1 mA	250 μA	25 μA	2.5 μA	0.25 μA

Overvoltage Protection	250V rms or dc, applied continuously to any range
Maximum Open-Circuit Voltage	3.3 volts
Response Time:	
200Ω - 200 kΩ range	1.0 seconds maximum to displayed input
2000 kΩ and 20 MΩ range	3.0 seconds maximum to displayed input
GENERAL	
Function	Selected via front panel controls
Range	Automatically or manually selected via front panel controls
Autorange Rate	600 ms maximum per range change
Display	7 segment 0.3" LED display, automatic decimal location
Reading Rate	2.5 readings per second, within the same range
Storage Temperature	–40°C to 75°C
Operating Temperature	0°C to +50°C
Humidity Range	70% R.H., +35°C to +50°C 80% R.H., +5°C to +35°C
Overload Indication	Flashing Display of +188888 (built-in segment test of LED display) for out of range indication
Shock and Vibration	Meets pertinent requirements of MIL-T-28800B, Class 5
MTBF	10,000 hours calculated, minimum
Protection Class 1	Relates solely to insulation and grounding properties defined in IEC 348.
Maximum Common Mode Voltage	1000V dc or peak ac
Maximum LO to GUARD voltage	100V dc or peak ac
Power	110/230V ac ±10%, 50 or 60 Hz, 8 watts
Size	Maximum deminsions (see Figure 1-1) 3.16" high x 9.0" wide x 14.2" long (8.03 cm x 22.86 cm x 36.07 cm)
Weight	6.5 lbs (3.0 kg)
Data Output Unit, (Option –02)	
Available Data	Digits, Polarity (both logic Senses), and Range.
Data Output (form)	Isolated BCD, with compatible TTL/DTL levels.
Data Coding	8-4-2-1 BCD positive true parallel (negative true easily obtained by changing output buffers)
Logic Levels	"1" = +5V, "0" = 0V
Drive Capability	All outputs can drive a min. of two TTL loads (i.e., sink 3.2 mA)
Flags	Busy, Not Busy, and Overload
Controls	External trigger (negative-going edge triggers); External trigger enable (Logic "1" enables external, trig. Logic "0" causes data update at the internal sample rate of approximately 2.5/second); +5V reference.

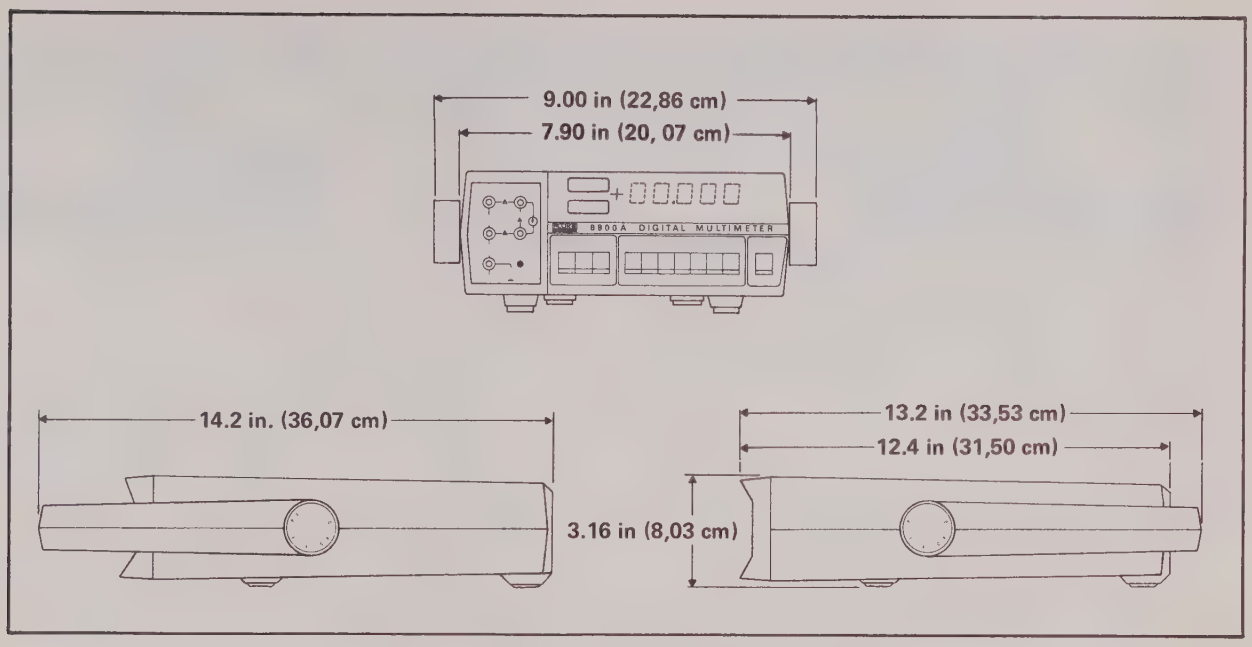
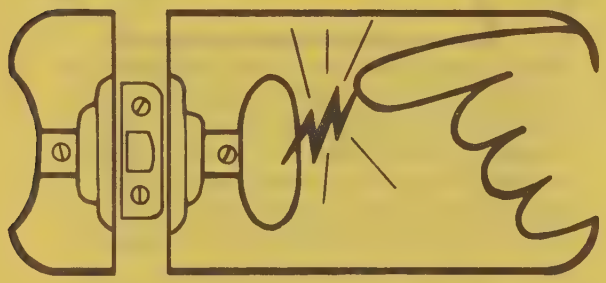


Figure 1-1. MODEL 8800A OUTLINE DRAWING

static awareness

A Message From

John Fluke Mfg. Co., Inc.



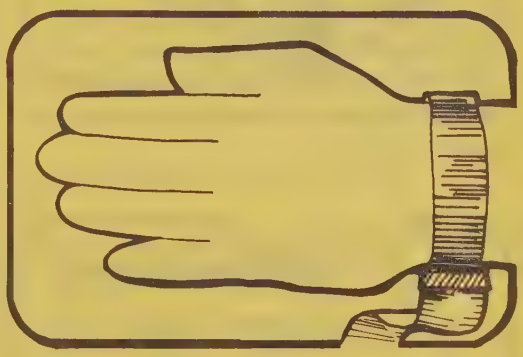
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

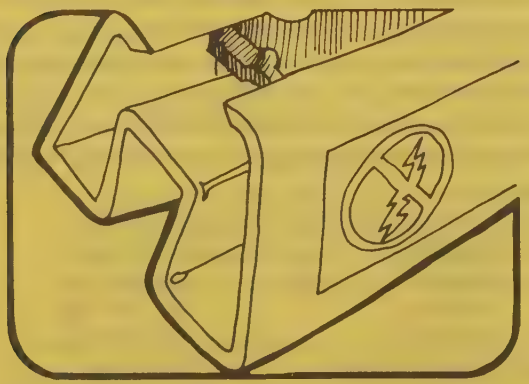
The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol "⊗"

The following practices should be followed to minimize damage to S.S. devices.

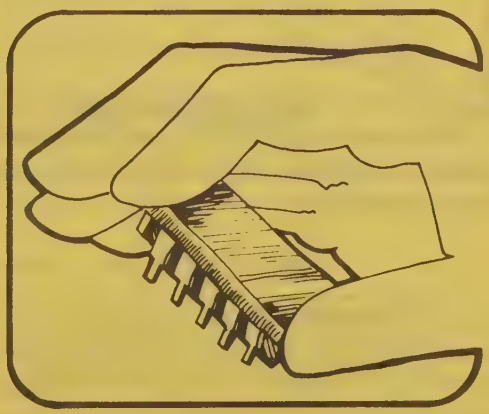
1. MINIMIZE HANDLING



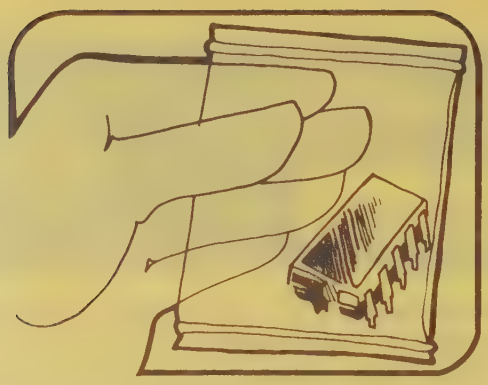
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES



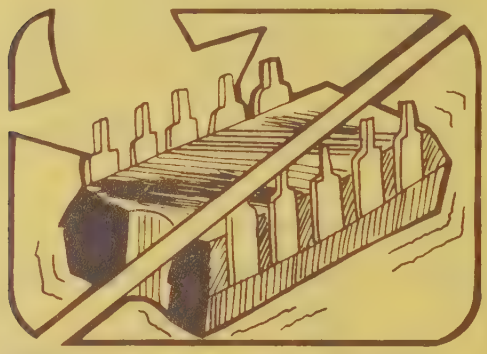
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



4. HANDLE S.S. DEVICES BY THE BODY



5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE

7. AVOID PLASTIC, VINYL AND STYROFOAM® IN WORK AREA

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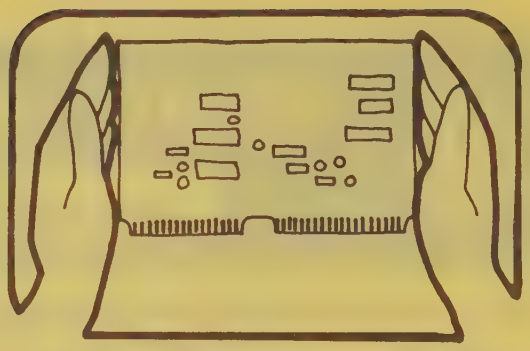
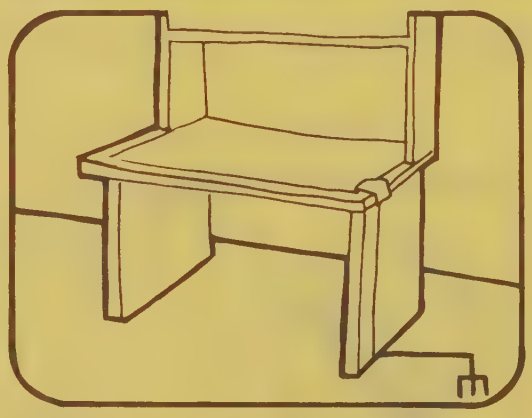
AND GENERAL DYNAMICS, POMONA DIV.



8. WHEN REMOVING PLUG-IN ASSEMBLIES, HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR USUALLY PROVIDES COMPLETE PROTECTION TO INSTALLED SS DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION
10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.
11. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

John Fluke Part No.	Description
453522	6" X 8" Bag
453530	8" X 12" Bag
453548	16" X 24" Bag
454025	12" X 15" Bag
Pink Poly Sheet 30"x60"x60 Mil P/N RC-AS-1200 $20.00	Wrist Strap P/N TL6-60 $7.00

® Dow Chemical

J0089B-07U7810/SE EN Litho in U.S.A.

Section 2
Operating Instructions

2-1. INTRODUCTION

2-2. This section contains information regarding the installation and operation of the Model 8800A. The contents of this section should be read before operating the digital multimeter. Should any difficulties be encountered during operation, contact your nearest John Fluke Sales Representative or the John Fluke Mfg. Co., Inc. P.O. Box 43210, in Mountlake Terrace, Washington, 98043. Telephone (206) 774-2211. A list of Sales Representatives is located in Section 7 of the manual.

2-3. SHIPPING INFORMATION

2-4. The Model 8800A was packaged and shipped in a foam packed cardboard carton. After unpacking the unit, a thorough inspection should be made to note any damage that may have occurred in transit.

2-5. If reshipment becomes necessary the instrument should be repackaged in the original container. If the original container is not available, a new one can be obtained from the John Fluke Mfg. Co., Inc. Please reference the model number (8800A) when requesting a new shipping container.

2-6. INPUT POWER

WARNING
LETHAL VOLTAGES MAY BE PRESENT AT THE LINE POWER INPUT CONNECTOR AND OTHER POWER SUPPLY COMPONENTS WHEN THE 8800A IS CONNECTED TO LINE POWER.

2-7. The Model 8800A may be powered from either 115 volts, 50 or 60 Hz, or 230 volts, 50 or 60 Hz. An internal slide switch allows either configuration of input voltage to be selected. The selection procedure is given in Section 4 of this manual. It should be performed only by a qualified technician. Refer to the decal on the bottom of the 8800A for the voltage selected at the factory.

2-8. RACK INSTALLATION

2-9. The Model 8800A can be mounted in a standard 19-inch equipment rack. A rack mounting kit (M00-200-625) is available to allow center mounting of the unit. Instructions for attaching the rack mount to the unit are supplied with each kit and in Section 6 of this manual.

2-10. OPERATING FEATURES

2-11. The function and location of the Model 8800A controls and indicators are provided in Figure 2-1 and Table 2-1.

2-12. OPERATING NOTES

2-13. The following paragraphs describe various conditions which should be considered before operating the Model 8800A.

2-14. AC Line Connection

2-15. The input power cord is a three-prong polarized connector which permits connection to 115 or 230 volts, 50 or 60 Hz line power. Insure that the ground pin on the power cord is connected to a high quality earth ground.

2-16. Input Connections

2-17. Five input terminals (INPUT - Ω SENSE, HI and LO; Ω SOURCE, HI and LO; and a GUARD) provided connection to the voltage source or resistance under measurement. Table 2-2 provides instructions for the proper connections and control setting for each multimeter function.

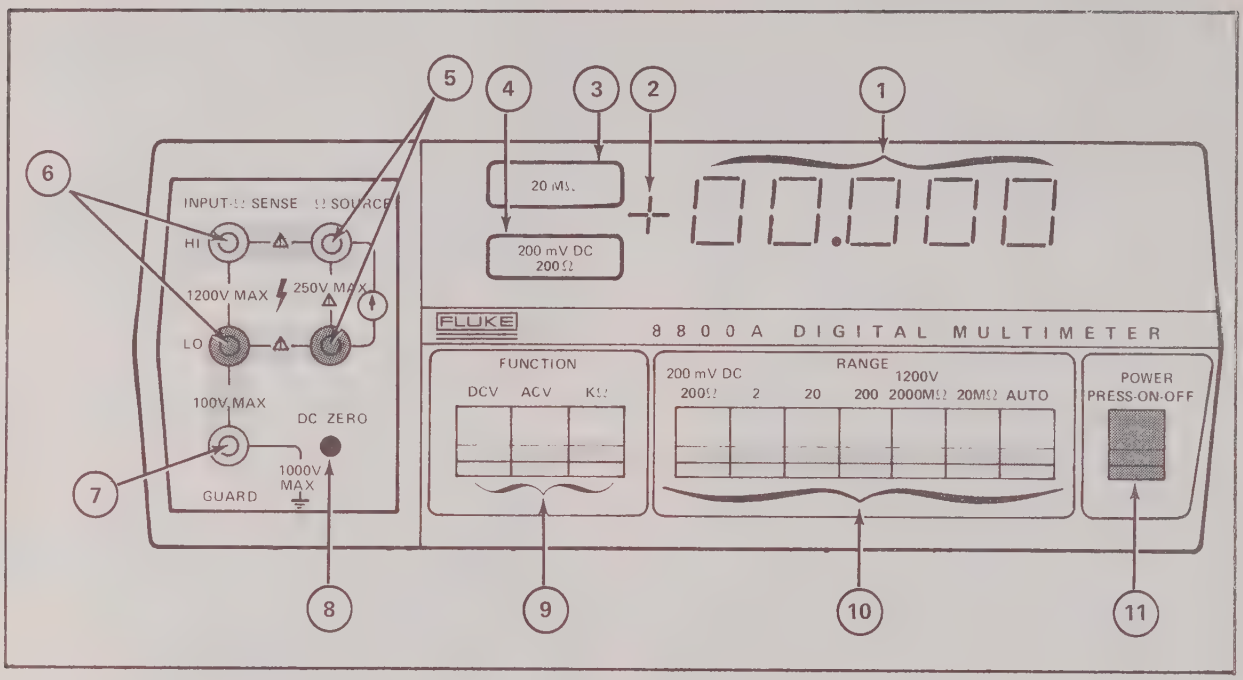


Figure 2-1. 8800A CONTROL AND INDICATOR LOCATIONS

Table 2-1. 8800A CONTROL AND INDICATOR FUNCTIONS

FIG 2-1 REF. NO.	NAME	FUNCTION
1	LED display	Provides a digital readout of the value of applied inputs.
2	Polarity indicator	Displays a + (positive) or – (negative) polarity indication for corresponding dc voltage inputs.
3	20 MΩ indicator	LED indicator lights when 20 MΩ RANGE is selected.
4	200 mVDC, 200Ω indicator	LED indicator lights when 200 mVDC, 200Ω range is selected
5	Ω SOURCE HI and LO terminals	Provide current through unknown resistance to be measured in KΩ FUNCTION.
6	INPUT - Ω SENSE HI and LO terminals.	Provides connections for ACV and DCV FUNCTION inputs and Ω SENSE input in KΩ FUNCTION.
7	GUARD terminal	Provides connection to internal voltmeter guard.
8	DC ZERO adjustment	Adjusts 8800A display for zero reading in ZERO ADJUST procedures. (See section –4, precalibration procedure)
9	FUNCTION pushbuttons	Selects the DCV, ACV or KΩ mode of operation.
10	RANGE pushbuttons	Selects discrete range or AUTO range in each function.
11	POWER pushbutton	Turns instrument on or off.

2-18. Input Terminal Voltage Limits

2-19. The maximum voltage limits that may be applied between adjacent input terminals, without causing damage to the 8800A, are provided below. In some cases the inter-terminal voltage limit will change when the function of the multimeter is changed. Do not exceed the limits given.

NOTE

The ⚠ symbol indicates that additional information is provided in the manual to prevent damage to the instrument.

a. INPUT - Ω SENSE HI to INPUT - Ω SENSE LO; 1000V dc max on the 200 mV - 20V ranges DC, 1200V dc max on the 200V - 1200V ranges DC. 1200V rms max on all ranges AC. 250V dc or rms when in the KΩ function.

b. Ω SOURCE HI to Ω SOURCE LO; When the KΩ function is selected, the maximum voltage that can be applied between the Ω SOURCE HI and LO terminals is 250V. 1200V max. when the VAC or VDC function is selected and the shorting links between the two HI and two LO terminals are used.

c. INPUT - Ω SENSE HI to Ω SOURCE HI and INPUT - Ω SENSE LO to Ω SOURCE LO; 0.5V max. when shorting links are removed.

CAUTION

Shorting link between INPUT - Ω SENSE HI and Ω SOURCE HI, and shorting link between INPUT - Ω SENSE LO and Ω SOURCE LO must be installed except when making 4 - terminal ohms measurements.

d. INPUT - Ω SENSE LO to GUARD; 100V max.

e. GUARD to earth ground; 1000V max.

CAUTION

Shorting link from GUARD to INPUT - Ω SENSE LO must be installed except when making guarded measurements.

2-20. Guarded Measurements

2-21. The 8800A employs a system of shields and guards that function, when properly connected, to minimize common mode to normal mode signal conversion. The common mode signal, represented by Ecm in Figure 2-4, is the difference in potential between the line receptacle or transformer core ground of the multimeter and the ground of the voltage source being measured. This common mode potential can be caused by voltage differences in the ground lines or currents induced in them.

2-22. The input lead and terminal link configuration illustrated in Figure 2-4 is for unguarded measurements; the most commonly used method. In this configuration it is possible for the common mode voltage (Ecm) to supply

TABLE 2-2. MEASUREMENT CONNECTIONS AND CONTROL SETTINGS

MEASUREMENT TO BE MADE	8800A			REMARKS
	FUNCTION	RANGE	INPUT CONNECTIONS	
± DC Voltage	VDC	200 mV, 2, 20 200, 1200 or AUTO	INPUT · Ω SENSE, HI to LO	8800A automatically selects highest range for chosen function if range is not manually called.
AC Voltage	VAC	2, 20, 200, 1200 or AUTO		
RESISTANCE	KΩ	200Ω, 2, 20, 200, 2000 kΩ 20 MΩ or AUTO		Use 4-terminal ohms measurement if desired. On all ranges the Ω SOURCE terminals must be connected either remotely (see Figure 2-2) or with shorting links (see Figure 2-3) to the INPUT - Ω SENSE terminals for all resistance measurements.

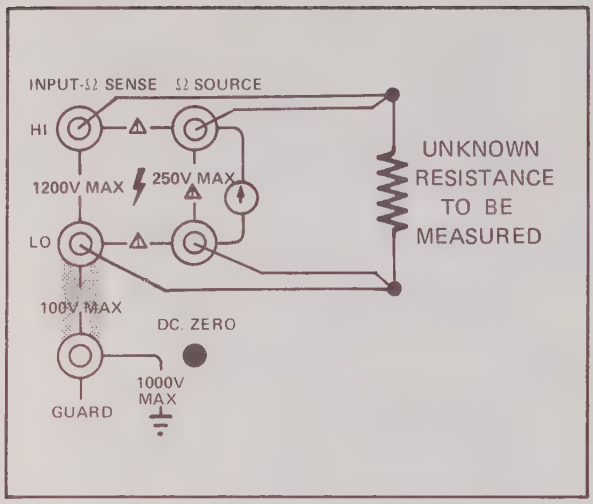


Figure 2-2. INPUT TERMINAL CONNECTIONS FOR 4-TERMINAL MEASUREMENTS

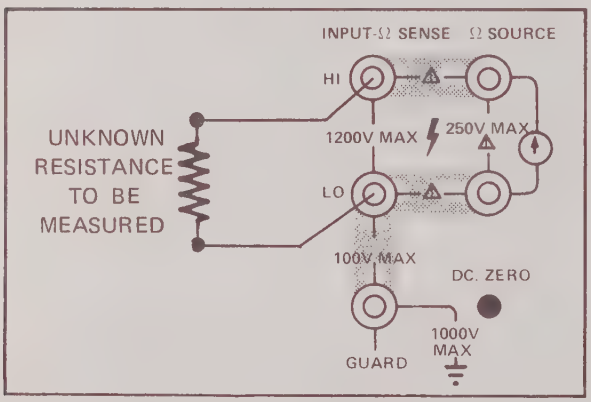


Figure 2-3. INPUT TERMINAL CONNECTIONS FOR 2-TERMINAL MEASUREMENTS

common mode current (Icm) via the test lead on the low input terminal, the guard to low-input shorting link, through the inner guard to transformer stray leakage paths, and back to the common mode source. This common mode current flow will cause a normal mode voltage drop across the lead resistance that will add to or subtract from the input voltage being measured. When the lead resistance increases (caused by long input leads or poor connections) or the common mode voltage increases, the common mode signal converted to a normal mode voltage can cause a noticeable error in the multimeter display.

2-23. The guard terminal on the 8800A front panel can be connected in a way that provides a signal path for the common mode current that does not go through the input leads carrying the normal mode voltage signal. These terminal connections, illustrated in Figure 2-5, provide for a guarded measurement of the applied input.

2-24. Guarded measurements can be obtained when the following conditions are met:

1. Remove link connecting guard terminal and low input.
2. Connect shield of the input leads to the guard terminal.
3. Connect input end of the shield to same point as the input low lead.

2-25. The above conditions, when met, will effectively extend the inner guard of the instrument out to the end of the input leads. The common mode current will then flow through the shield on the input leads to the guard terminal, across the inner guard to the outer case stray leakage paths, and back to ground. Therefore the current no longer flows through the input lead to create the error voltage.

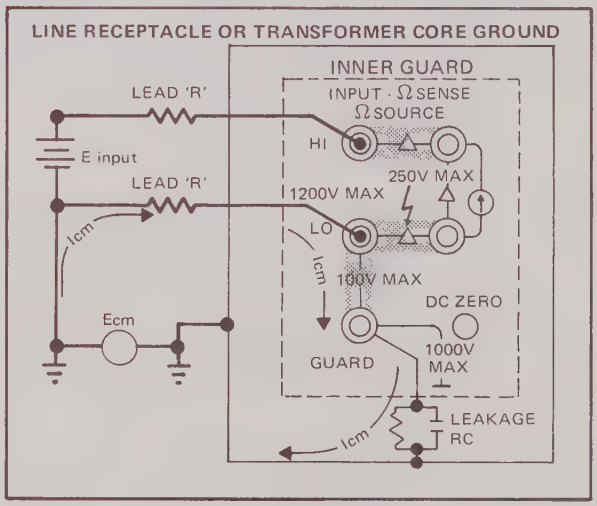


Figure 2-4. UNGUARDED MEASUREMENT TERMINAL CONFIGURATION

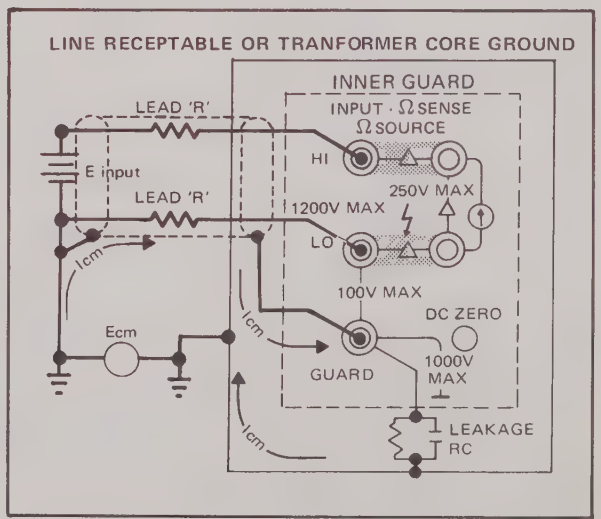


Figure 2-5. GUARDED MEASUREMENT TERMINAL CONFIGURATION

Section 3
Theory of Operation

3-1. INTRODUCTION

3-2. The theory of operation for the Model 8800A is arranged under two major headings. The first, titled OVERALL FUNCTIONAL DESCRIPTION, discusses the overall operation of the instrument in terms of the functional relationship of the major circuits. The second heading is titled SIMPLIFIED CIRCUIT ANALYSIS and deals with the internal operation of each major circuit in more detail. Block diagrams and simplified circuit diagrams are included in this section. The complete schematic diagrams are located in Section 8 of this manual.

3-3. OVERALL FUNCTIONAL DESCRIPTION

3-4. Introduction

3-5. The 8800A circuitry can be divided into three major sections. The first of the three sections, termed the Input Signal Conditioners, (see Figure 3-1) comprises the Ohms Converter, VDC Buffer and AC Converter. The second section is the A/D (analog-to-digital) Converter and the third is the Control and Display section. The basic operational relationship of these functional areas is shown in Figure 3-1 and will be discussed in the following paragraphs.

3-6. Input Signal Conditioners

3-7. The term, input signal conditioner, describes the basic function of the three subsections grouped under it. The ohms converter, AC converter and VDC buffer provided the A/D converter with a dc analog voltage representative of the input (ac volts, dc volts, or resistance) applied to the instrument. The basic path that each input signal follows as it is conditioned for the A/D converter is illustrated in Figure 3-1.

3-8. When making a dc voltage measurement the unknown voltage applied to the INPUT HI and LO terminals is directed to the DCV Buffer. The buffer then either amplifies the input voltage (200 mV range), passes the entire input voltage (2V range) or divides the input voltage by some power of ten (20, 200 and 1200V ranges), so that a "conditioned" signal of two volts dc at the A/D Converter is representative of a full scale instrument input for all ranges.

3-9. AC voltage inputs applied to the INPUT HI and LO terminals are directed through closed switch contacts to the AC Converter. These ac input voltages are then converted to dc voltages so that a full scale ac voltage input on any range will produce an AC Converter output to the A/D Converter of two volts dc.

3-10. When measuring an unknown resistance, the INPUT HI and LO terminals must be connected to the respective SOURCE HI and LO terminals. The shorting links provided on the front panel make the connection for two-terminal ohms measurements and the input leads attached to the terminals make the connection during four-terminal ohms measurements.

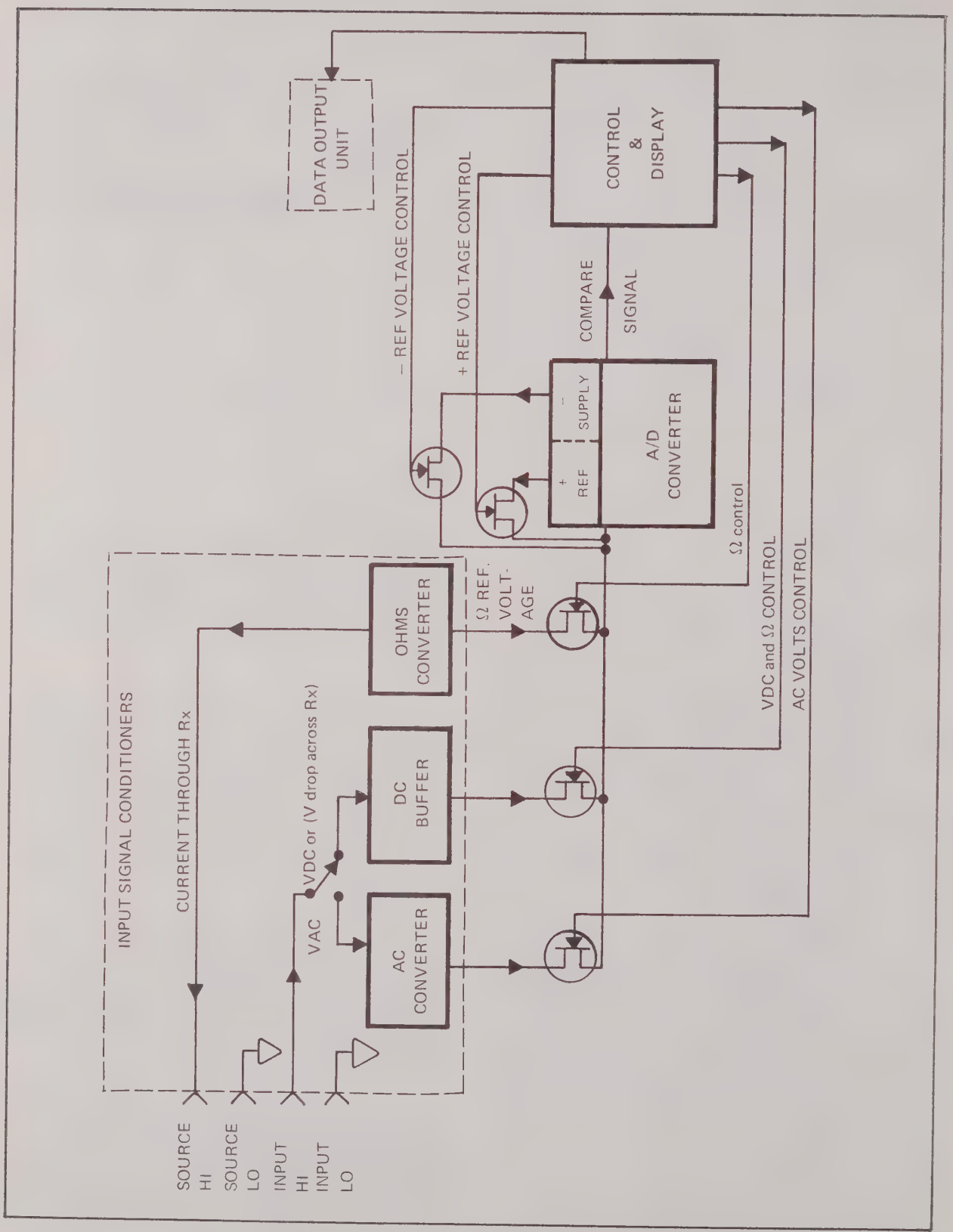


Figure 3-1. OVERALL FUNCTIONAL BLOCK DIAGRAM

3-11. The unknown resistance (RX) is supplied with current from the Ohms Converter while the voltage drop across RX, caused by the current, is applied to the VDC Buffer as a representation of the unknown resistance. The Ohms Converter also applies the same current through a known resistance value to develop a reference voltage used in the A/D Converter in the KΩ function.

3-12. A/D Converter

3-13. A dual slope intergration technique is used in the 8800A. The A/D Converter receives the dc voltage output from one of the Input Signal Conditioners and integrates it for 100 mS. Figure 3-2 is an illustration of the output of the A/D integrator. The slope of the integrator output voltage during the Integrate Period is proportional to the input applied to the instrument. At the end of the integrate period the signal conditioner dc voltage is disconnected from the A/D input and a dc reference voltage, of opposite polarity, is connected to the input(start of the read period). The A/D Converter then integrates the reference voltage so that the slope of the Read Period is always constant. Since the read period slope is held constant the time required for the A/D integrator output voltage to return to the zero detect point is then proportional to the instrument input.

3-14. The digital representation of the input is obtained by counting the number of cycles of a clock oscillator frequency that occur from the start of the read period to the point where the A/D integrator output voltage returns to the zero detect level. The A/D Converter supplies the Control and Display section with a compare signal at the end of the read period. The compare signal stops the counting of the clock oscillator pulses so that the analog value of the instrument input is now digitally represented by the number of oscillator pulses counted.

3-15. Control and Display

3-16. The Control and Display section provides the properly timed signals that direct the output of the correct Input Signal Conditioner to the A/D Converter during the integrate period. At the end of integrate time period the Control and Display section connects the appropriate reference supply to the A/D Converter input for the read period. The output of the 1 MHz oscillator is used to maintain the proper timing of the control signals.

3-17. The clock oscillator pulse count, accumulated during the read period, is applied to the LED display to produce the digital readout of the instrument input signal. The range information for the selected range, position the decimal point and illuminates the proper display annunciator.

3-18. Data Output Unit (Option-02)

3-19. The DOU provides the display data as a rear panel card-edge output. The bcd information presented to the instrument display (polarity, overload, range code, and digit) is also applied to the DOU input. A busy flag is provided to indicate that the output data is invalid while the 8800A is taking a new input measurement. A register pulse train plus one of the data strobe signals time the data transfer to ensure that the data supplied to the DOU output is stable and not taken during the transition periods between individual digit information.

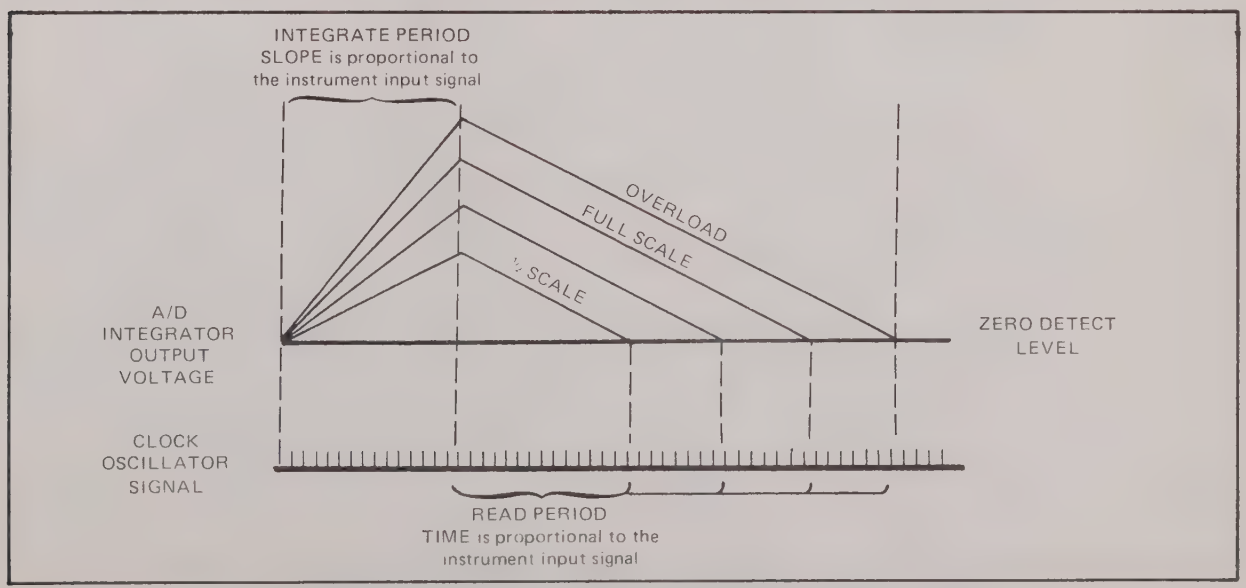


Figure 3-2. TIMING DIAGRAM FOR DUAL-SLOPE A/D CONVERSION

3-20. CIRCUIT DESCRIPTION

3-21. The following paragraphs provide an analysis of the functional areas of the 8800A at a simplified circuit level. The simplified circuits described in these paragraphs correspond to the associated detailed schematic diagrams included at the end of this manual.

3-22. Component reference designators mentioned in the text identify the component on the simplified circuit drawings and on the schematic diagrams. The reference designators for integrated circuits containing two or more gates or functions are presented in text with a numeric suffix. This suffix corresponds to an integrated circuit pin of the particular gate or function. For example, the reference designator U11-6 identifies integrated circuit number 11 and the specific gate or function associated with pin six.

3-23. Input Signal Conditioners

3-24. AC CONVERTER

3-25. The AC Converter produces a dc output voltage proportional to the ac input voltage. The simplified circuit diagram of the AC Converter, presented in Figure 3-3, should be refered to when reading the following description of the circuit operation.

3-26. The ac voltage input is capacitively coupled across C1 through input impedance resistor R1 to the inverting input of amplifier Q1, U1. The gain of the amplifier is determined by the ratio of the feed-back resistance, as selected by range relays K6, K7 and K8, to the input resistor R1. The amount of alternating current at the junction point of CR4 and CR5 is therefore proportional to the level of the ac voltage input. One-half of the alternating current passes through CR5 to develop a dc voltage level at the input of Low Pass (L.P.) Filter. The L.P. Filter then filters the ac signal superimposed on the dc voltage to produce a dc output voltage directly proportional to the ac voltage input.

3-27. The AC Converter circuitry creates an offset voltage that, if not compensated for, would create an error in the displayed value of the ac input voltage. The offset voltage, sensed at the junction point of R17, C13, C14, and C26 is applied to C18 when FET switches Q6 and Q9 are turned on; these switches are turned off by an integrate (INT)

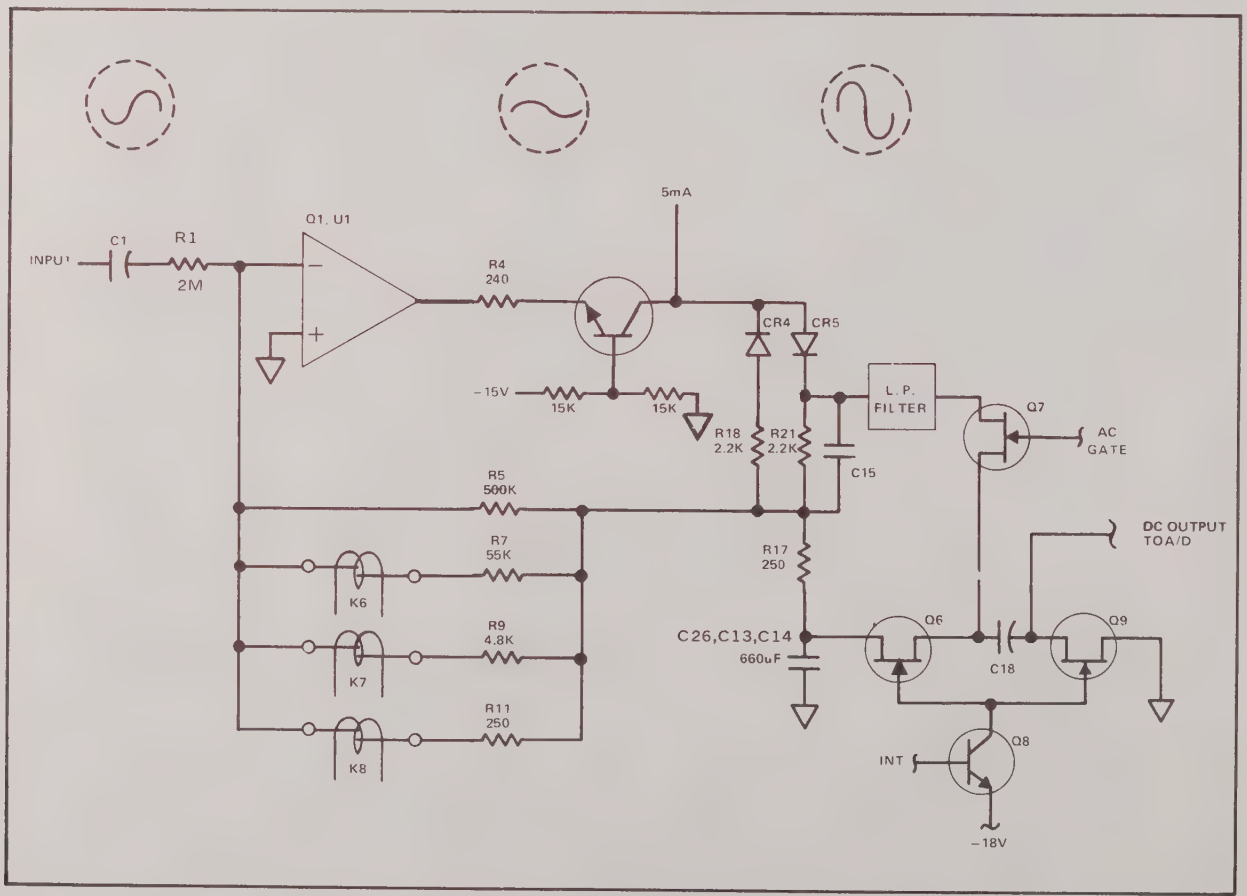


Figure 3-3. AC CONVERTER SIMPLIFIED CIRCUIT DIAGRAM

signal applied to Q8. When the AC GATE command (coincidental with the INT command) turns on Q7, the dc output voltage of the L.P. Filter will be reduced by the value of the feed-back voltage store in C18. The dc voltage output to the A/D Converter is therefore representative of the level of ac voltage input.

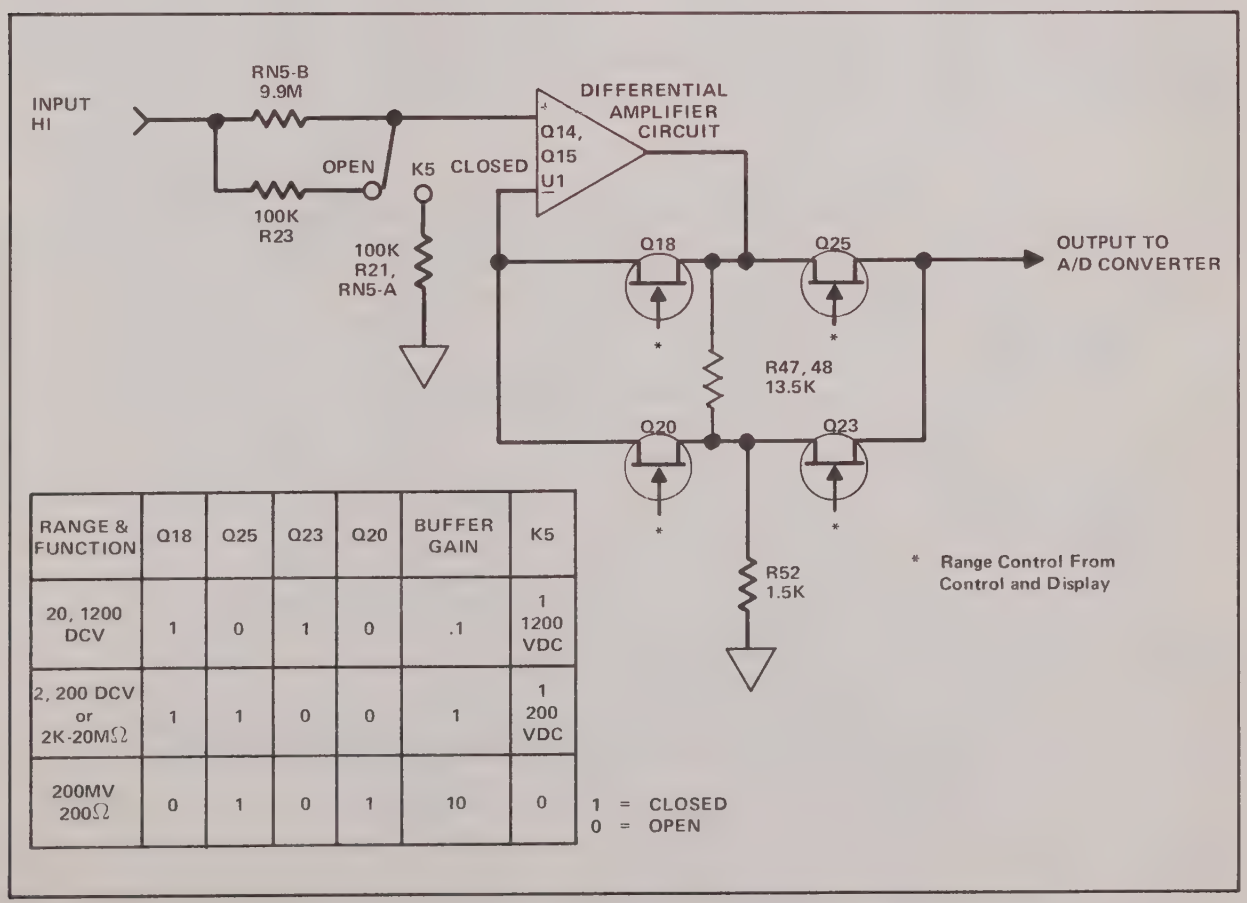
3-28. DC BUFFER

3-29. DC voltage inputs applied to the instrument are conditioned by the DC Buffer so that an input within any dc voltage range chosen produces a buffer output of two volts dc or less. The simplified buffer circuit shown in Figure 3-4 will be used to illustrate how the overall gain of the buffer is changed with range selection in order to maintain the required output. The ohms function also uses the DC Buffer when determining the value of an unknown resistance. As indicated by the table in Figure 3-4 the buffer gain is 1 (unity) for the 2K thru 20MΩ ranges and 10 for the 200Ω range.

3-30. When the 200 mV or 200Ω range is selected,FET switches Q25 and Q20 close. This configuration produces a differential amplifier circuit gain of ten by returning only one-tenth of the amplifier output back to the inverting input. The DC Buffer output through Q25 to the A/D Converter will be two volts for a full scale input of 200mV or 200Ω.

3-31. A differential amplifier circuit gain of one is obtained when the 2 or 200 DCV range, or 2k thru 20MΩ range is selected. Range control signals from the Control and Display circuits close switches Q18 and Q25. Direct feedback through Q18 causes the differential amplifier to operate at unity gain. This amplifier circuit configuration produces the required two volt output to the A/D Converter representing a full scale instrument input. Selecting the 200 volt range in the DCV function, in addition to configuring the differential amplifier circuit for unity gain, closes relay K5 to provide a 100:1 voltage divider (RN5-B, R21, and RN5-A) to reduce a full scale 200 volt instrument input to two volts at the amplifier input.

3-32. Switches Q18 and Q23 close when either the 20 volt or 1200 volt range is selected. Selecting the 1200 volt range



RANGE & FUNCTION	Q18	Q25	Q23	Q20	BUFFER GAIN	K5
20, 1200 DCV	1	0	1	0	.1	1 1200 VDC
2, 200 DCV or 2K-20MΩ	1	1	0	0	1	1 200 VDC
200MV 200Ω	0	1	0	1	10	0

1 = CLOSED
0 = OPEN

Figure 3-4. VDC BUFFER SIMPLIFIED CIRCUIT DIAGRAM

also causes relay K5 to close, again creating a 100:1 voltage divider across RN5-B, R21, and RN5-A. This voltage divider reduces the high instrument input voltages (1200 volts maximum) to 12 volts or less at the differential amplifier circuit input. The output of the differential amplifier circuit is applied to a 10:1 voltage divider consisting of R47, R48, and R52. The differential amplifier circuit, operating at unity gain when Q18 is closed, applies up to 20 volts in the 20 DCV range and 12 volts in the 1200 DCV range to the voltage divider. The voltage divider is tapped, through Q23, to provide one-tenth of the amplifier output to the A/D Converter.

3-33. OHMS CONVERTER

3-34. The Ohms Converter determines the value of an unknown resistance by comparison. When the same current is applied to a resistance of known value and a resistance of unknown value the voltage level developed across each is directly proportional to the value of each resistance. A comparison of the two voltage levels will indicate the value of the unknown resistance relative to the value of the known resistance. The simplified circuit diagram, in Figure 3-5 shows how the Ohms Converter produces the two voltages to be compared by the A/D Converter.

3-35. The current used to develope the voltage across the known range resistor and the unknown resistor is supplied by a constant current source consisting of an emitter follower (Q2 and R3), a voltage reference (CR2), and a feedback circuit (Q1 and Q21). Current regulation is accomplished by the emitter follower with CR2 acting as the reference voltage source. The path for the regulated current starts at the emitter follower (R3 and Q2) and continues through the overload transistors (normally on) diode CR12, the selected range resistor, and finally through the unknown resistor. Feedback components Q1 and Q21 adjust the bias on CR2 and, thus, control the maximum current available on any given range. This ensures optimum voltage distribution between the range resistor (1 volt) and the unknown resistor (0 to 2 volts), regardless of the range selected.

3-36. The ohms converter also employs an overvoltage protection circuit consisting of Q2, Q22, and Q23, such that it can withstand up to 250V dc or inadvertently being connected to the ohms converter input leads. The high voltage applied to the protection circuit in such a case is enough to make appreciable reverse current to flow through Q23. This will effectively connect Q23 and Q22 in series, since each transistor has a standoff of 80V the total is now 160V. If the voltage continues to rise Q2 will also be in series and the total standoff will then be greater than 250V. The current in this case is dissipated by resistors R35, R36, and R37.

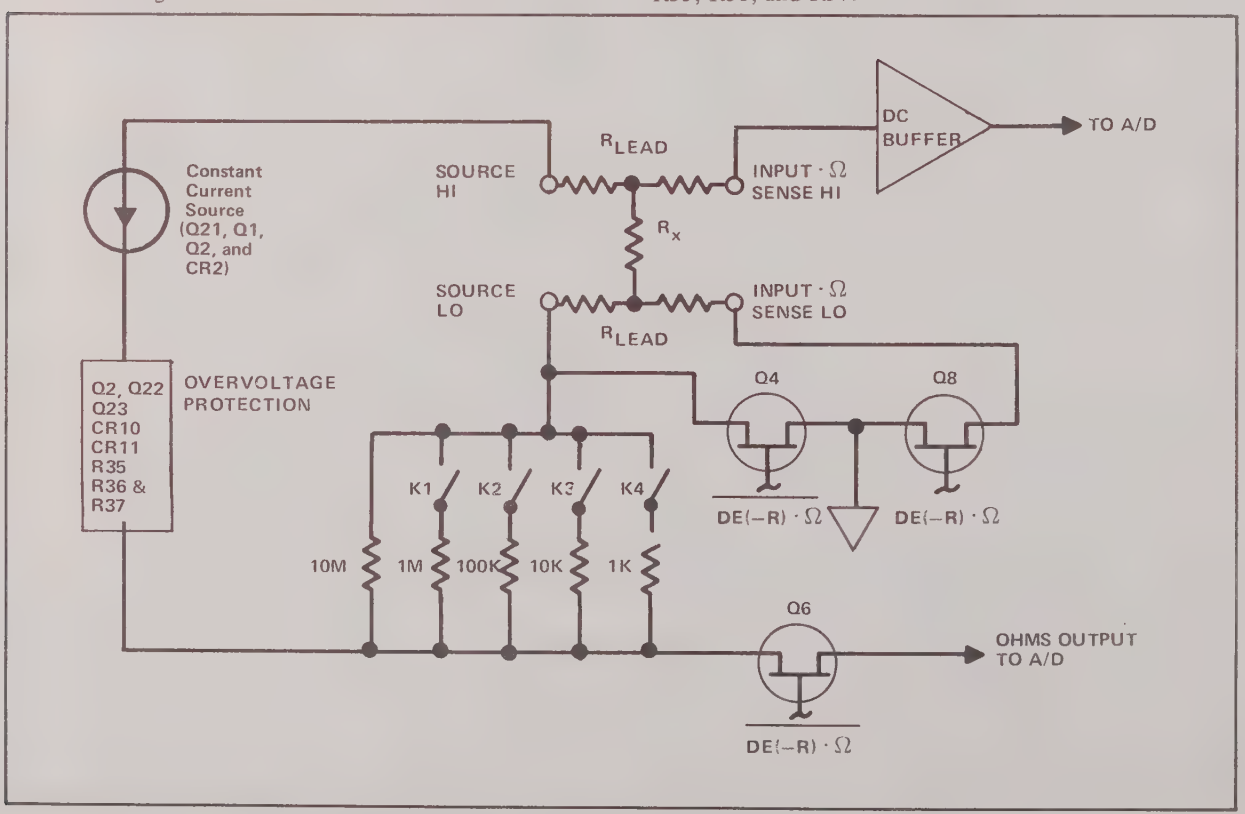


Figure 3-5. OHMS CONVERTER SIMPLIFIED CIRCUIT DIAGRAM

3-37 During the integrate time period (see Figure 3-2) the DE(–R) · Ω control signal closes switch Q8. The positive voltage developed by the current flow across R_X is applied through the INPUT · Ω SENSE HI terminal to the DC Buffer and A/D Converter. At the end of the integrate period Q8 opens and Q4 and Q6 close. The negative voltage developed across the known resistance, termed ohms output, passes through Q6 to the A/D Converter.

3-38. A/D Converter

3-39. The A/D Converter uses a dual-slope conversion technique. The dc voltage input to the A/D Converter, representing an unknown value of instrument input, is integrated (charges a capacitor) for a controlled length of time (100ms). The level to which the capacitor is charged is directly proportional to the level of the dc voltage at the input. The capacitor is then discharged at a controlled rate so that the discharge time is proportional to the level of charge on the capacitor. A digital representation of the discharge time is obtained by counting the number of cycles of a reference frequency that occur from the start of discharge to the point where the capacitor charge reaches a selected zero detect level. Figure 3-6 is a basic illustration of the A/D Converter circuit.

3-40. The input to the A/D Converter is selected from one of the three input signal conditioners. The selected input is applied to U3, a unity gain input buffer, during the integrate time period. The buffer output passes across Q39 to an integrator the output of which is determined by the level of input applied. The integrator output charges capacitor C9 at a rate determined by the input so that at the end of the 100 ms integrate time period the charge on the capacitor is directly proportional to the input applied. At the end of the integrate time period the integrator is isolated from the buffer when control signal △ 2 opens Q39 for 1ms. This allows the input to U3 to be changed from the dc voltage representing the unknown input to the appropriate reference input without affecting the charge stored on C9.

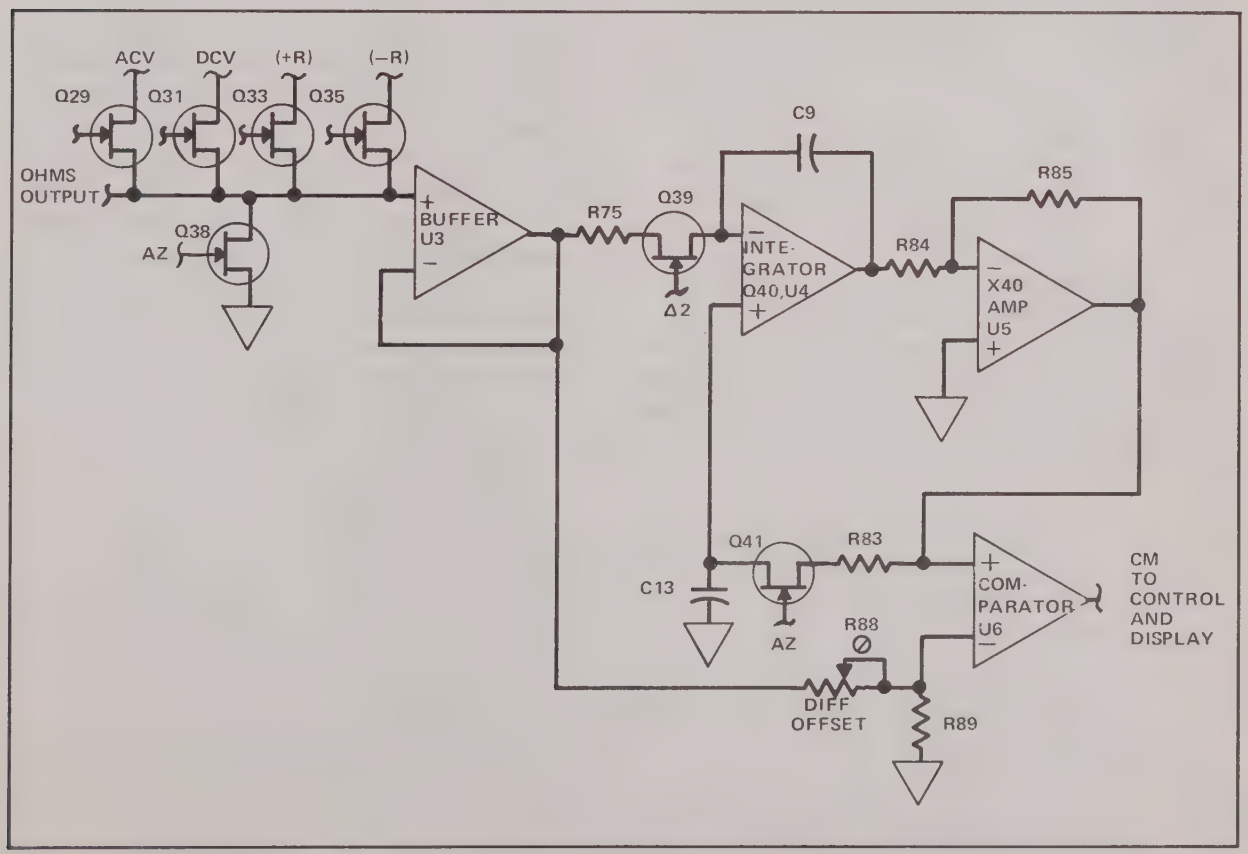


Figure 3-6. A/D CONVERTER SIMPLIFIED CIRCUIT DIAGRAM

3-41. The reference voltage passes through U3 and Q39 to the input of the integrator. Because the polarity of the reference voltage is opposite that of the unknown; the integrator starts to discharge capacitor C9. The rate of discharge is determined by the value of the reference voltage. The charge on C9 is applied to the input of amplifier U5. The amplified output is applied to one input of comparator U6. A dc voltage level, determined by the differential offset adjustment R88, is connected to the other comparator input. When the decreasing charge on C9 reaches the same level as that provided by the differential offset adjust, U6 will produce a compare (CM) output signal to stop the digital count in the Control and Display circuit.

3-42. Control and Display

3-43. The discussion of the Control and Dispaly circuit operation that follows is referenced to the schematic diagrams in Figures 8-2 and 8-3. These schematics are located in Section 8 of this manual. Operation in the VAC FUNCTION will be used as an example of circuit operation.

3-44. Selecting the VAC FUNCTION switch S2 (see Figure 8-2) provides the AC control command output at J2 pin 2 and connects the INPUT HI terminal to the AC Converter input. The AC signal is applied to NAND gates in U15 (see Figure 8-1, Sheet 2) and to switch U20 where it selects the ST2 signal output for P2 pin 14. With the proper gates enabled by the AC command the outputs from U11, derived from the 1 MHz oscillator signal, provide timing commands to control the multimeter circuits during the ac volts measurement.

3-45. The measurement cycle starts with the INT signal output at U11 pin 40. This signal is inverted by U15-5 to produce the INT command which, when combined with the AC command at U15-9, results in the INT · AC signal used to gate the AC Converter output into the A/D Converter during the integrate time period. As the INT signal U11-40 goes high, indicating the end of the 100ms integrate time period, the 2 signal at U11-3 goes high for 1ms while the input to the A/D Converter is switched from the unknown to the reference voltage. The reference supply signal comes from U11-39, DE(−R). This signal is inverted by U13-14 and applied to U14-3. Since U14 pin 5 is held high, unless the KΩ function is called, the DE(−R) · Ω command will gate the negative one volt reference to the A/D Converter input for the read time period.

3-46. At the end of the△2 signal decade counters within U11 start to count the cycles of the 1 MHz oscillator input at U11 pin 6. The count accumulation continues until a compare (CM) signal from the A/D Converter is received at U11 pin 5. The total in each decade counter is converted to a bcd format, identified as signals W, X, Y, and Z with corresponding bit weights of 8, 4, 2, and 1. The digit information is strobed out to the display from pins 34, 33, 32, and 31 of U11 one significant digit at a time.

3-47. Eight strobe signals numbered ST0 through ST7, are created within U11 to properly time the transfer of data from U11 to the display. Six strobe signals (ST0, ST1, ST2, ST3, ST4, and ST6) are used to transfer digit information and the remaining two (ST5 and ST7) transfer range, polarity and overload data. The most significant digit of the display is the first to be strobed out of U11. Strobe signal ST7 from U11-22 passes through switch U20 pin 12 to 14 (DCV function causes the switch to shift to pin 13) to the display strobe drivers Q44 and Q45. The DS1 output signal on P1-3 is applied to pins 1 and 14 of the most significant digit LED (DS1), enabling only that LED to display the incoming digit information. The same ST7 strobe signal is used within U11 to cause the bcd information for the most significant digit to be applied, via U11 pins 34, 33, 32, and 31, to the seven segment decoder U16. The bcd code input causes the decoder to illuminate segments of the LED to display the corresponding number. Each LED is individually strobed to display the corresponding significant digit output from U11.

Section 4
Maintenance

WARNING!

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

4-1. INTRODUCTION

4-2. This section of the manual contains information concerning maintenance and servicing of the Model 8800A Digital Multimeter. A calibration interval of 90 days is recommended to insure instrument operation within the 90-day specifications. Test equipment recommended for performance tests, calibration adjustments and troubleshooting is listed in Table 4-1. If the recommended equipment is not available, equipment of equivalent specifications may be used.

Table 4-1. REQUIRED TEST EQUIPMENT

NOMENCLATURE	MINIMUM SPECIFICATIONS	RECOMMENDED EQUIPMENT
AC Calibrator	Voltage Range: 0 to 1000V ac Frequency Range: 50 Hz to 100 kHz Voltage Accuracy: 50 Hz to 20 kHz 0.03% 20 kHz to 100 kHz 0.05%	John Fluke Model 5200A and 5205A
DC Calibrator	Voltage Range: 0 to 1000V dc Accuracy: 0.003%	John Fluke Model 332B
Voltage Divider	Ratio Range: 0 to 1.0 Absolute Linearity: ±1 ppm of input at dial setting	John Fluke Model 720A
Resistor Decade	Resistance Accuracy: 0.005%	ESI 1063B
Frequency Counter	Range: 2 MHz Resolution: 100 Hz	John Fluke Model 1900A
Oscilloscope	General Purpose with 10MΩ Probe	Tektronics Model 453
Digital Multimeter	Voltage Accuracy: 0.1% Input Impedance: 10MΩ	*John Fluke Model 8000A

* If the selectable offset voltage correction resistor procedures are performed a DVM with a 1μV resolution is required; recommend a John Fluke 8400A or 8800A.

4-3. SERVICE INFORMATION

4-4. Each instrument manufactured by the John Fluke Mfg. Co., Inc. is warranted for a period of one year upon delivery to the original purchaser. The WARRANTY is printed on the back of the title page located at the front of the manual.

4-5. Factory authorized calibration and service for each Fluke product is available at various world wide locations. A complete list of these service centers is included with the WARRANTY. Shipping information is given in Section 2 of this manual. If requested an estimate will be provided to the customer before any repair work is begun on instruments that are beyond the warranty period.

4-6. GENERAL MAINTENANCE

4-7. Access/Disassembly

4-8. The following procedure is used to gain access to the interior of the 8800A.

a. Remove the line power cord from the unit.

b. Remove the molded plastic outer cover; two screws at the rear of the unit hold it in place. This provides access to the calibration adjustment.

c. Remove the top and bottom guard covers; slide the covers one-half the distance to the rear of this unit, then lift straight up to remove. This allows access to the components on the various printed circuit boards.

CAUTION

The area on the Display PCB Assembly where the input terminals extend through, must not be contaminated in any way. The inter terminal leakage caused by contamination will result in calibration errors.

d. Remove the AC Converter PCB or Ohms Converter PCB by disconnecting the associated wires and pulling the pcb straight away from the Main PCB.

NOTE

When reinstalling the AC Converter and Ohms Converter PCB's, insure that all connector pins are properly aligned before seating the board.

4-9. Cleaning

4-10. Clean the instrument periodically to remove dust, grease and other contamination. Use the following procedure:

a. Clean the front panel and exterior surfaces with anhydrous ethyl alcohol or a soft cloth dampened with a mild solution of detergent and water.

b. If cleaning of the inerior is necessary use clean, dry air at low pressure (20 psi). If contaminants remain individual pcbs can be cleaned using warm water, however; any items likely to be affected by the water should be removed first. Excess water should be blown free with the clean dry air followed by a thorough drying. Do not use drying temperatures in excess of 50°C. If any solvent is used, such as freon, it should be kept clear of any switches or potentiometers since it removes lubrication and shortens the life span dramatically.

4-11. Line Voltage Selection

4-12. Use the following procedure to change the line voltage setting (115 or 230V ac):

a. Disconnect the power cord from the 8800A.

b. Remove the unit from its case.

c. Remove the guard covers and locate the line voltage selection switch next to the transformer on the Main PCB Assembly.

d. Set the slide switch to the desired line voltage (115 or 230V ac).

e. Install the proper fuse for the selected voltage as described in the following paragraph.

4-13. Fuse Replacement

WARNING

LINE POWER VOLTAGE IS PRESENT AT THE FUSE HOLDER WHENEVER THE POWER CORD IS CONNECTED. REMOVE THE POWER CORD BEFORE SERVICING THE FUSE.

4-14. The power fuse (F1) is located in the right rear corner of the instrument, and can be reached by performing the access and disassembly procedure. If replacement is necessary, use a ¼ ampere fuse for 115V ac or a 1/8 ampere fuse for 230V ac.

4-15. LED Replacement

4-16. The following procedure is used to replace the Display or indicator LEDs.

a. Perform steps a, b and c of the Access/Disassembly instructions, paragraph 4-8.

b. Disconnect, at the main pcb dip sockets, the two flat cables connecting the Front Panel.

c. Disconnect the wires from the connector posts on the display pcb.

d. Remove the four side screws connecting the Front Panel to the side chassis. Lift the Front Panel away from the main portion of the instrument.

e. Remove the binding post nuts and the two phillips screws and lift the display pcb away from the Front Panel.

f. Unsolder the defective display or indicator LED and replace.

g. Reassemble in the opposite order, insuring the switch pushbutton connects between the crossbar and the lower retaining ring on the switch plunger. An illustration of the switch assembly is shown in Section 5.

4-17. Component Modifications

4-18. On versions of the Main PCB etched with the part number 8800A-3001, Rev. A through Rev. J, U5 is drilled to accept an eight lead dual in-line IC. However, the preferred replacement is the round TO-5 metal package. To fit the round TO package into the rectangular pattern, bend the legs into the correct position with a pair of long nosed pliers and insert the legs into the drilled holes, remembering that the TO package is keyed on pin 8 while the drill pattern is keyed with the square marked hole at position 1.

4-19. PERFORMANCE TESTS

4-20. The following tests are intended for use in performance testing of the 8800A. The tests compare the instrument performance to the accuracy specifications and are especially suited to acceptance testing of new instruments. Tests should be conducted under the following conditions: ambient temperature 23°C ±5°C, relative humidity less than 70%.

NOTE

Tolerances and test limits for performance tests are derived from the 90-day instrument specifications. A one-half hour warm up is assumed.

4-21. Should the 8800A fail this performance test, corrective maintenance or calibration will be required. The troubleshooting information given later in this section will help analyze and isolate the problem. The 8800A performance test will evaluate each of the three multimeter functions using the procedure provided in the following paragraphs. Use the test equipment recommended in Table 4-1.

4-22. DC Volts Verification

4-23. Using the dc calibrator and voltage divider apply the voltages indicated in Table 4-2 to the 8800A input terminals. Select the ranges prescribed and observe the 8800A display for the proper results.

NOTE

Use the 720A with the 332B DC Calibrator to source all voltages below 2 volts.

NOTE

Before starting this procedure, place a good quality shorting link across the INPUT - Ω SENSE terminals HI to LO and adjust the front panel DC ZERO for a display of exactly zero.

Table 4-2. DC VOLTAGE VERIFICATION

RANGE	INPUT	DISPLAY READING			LED INDICATION
2 VDC	Shorted	−.00003	–	+.00003	
	+1.00000	+.99987	–	+1.00013	
	−1.00000	−1.00013	–	−.99987	
	+1.90000	+1.89978	–	+1.90022	
	−1.90000	−1.90022	–	−1.89978	
20 VDC	+19.0000	+18.9978	–	+19.0022	
	−19.0000	−19.0022	–	−18.9978	
200 VDC	+190.000	+189.978	–	+190.022	
	−190.000	−190.022	–	−189.978	
1200 VDC	+1000.00	+999.87	–	+1000.13	
	−1000.00	−1000.13	–	−999.87	
200 mV	+.10000	+99.980	–	+100.020	200m VDC
	−.10000	−100.020	–	−99.980	200m VDC
AUTO	+.10000	+99.980	–	+100.020	200m VDC
	+1.00000	+.99987	–	+1.00013	
	+10.0000	+9.9987	–	+10.0013	
	+100.000	+99.987	–	+100.013	
	+1000.00	+999.87	–	+1000.13	

4-24. Auto Ranging Verification

4-25. Verify that the Auto Ranging circuitry changes ranges at the proper voltage points using the following procedure:

a. Insure the dc calibrator and voltage divider are connected for an input to the 8800A.

b. Select AUTO on the front panel.

c. Apply +200mV to the 8800A.

d. Display reads +.19995 to +.20005.

e. Decrease the applied voltage to 183 mV. Display reads +.18295 to +.18305.

f. Decrease the applied voltage in 1 millivolt steps until the 8800A autoranges. The 200 mV - 200Ω LED indicator comes on and the applied voltage is between 177.5 and 182.5 millivolts. The display should read the applied voltage in millivolts ±.29 millivolts.

g. Slowly increase the applied voltage until the 8800A autoranges to the 2 volt range. The 200 mV - 200Ω LED indicator is extinguished, the decimal point on the display moves two positions to the left and the applied voltage is approximately, but greater than 190 millivolts.

4-26. AC Volts Verification

4-27. Using the ac calibrator, apply the voltages indicated in Table 4-3, to the 8800A input terminals. Select the range and observe the 8800A display for the proper results.

Table 4-3. AC VOLTAGE VERIFICATION

RANGE	VOLTAGE	FREQUENCY	DISPLAY READING
2 VAC	1.00000	400 Hz	.99890 – 1.00110
2 VAC	1.0000	100 kHz	.98940 – 1.01060
20 VAC	10.0000	400 Hz	9.9890 – 10.0110
20 VAC	10.0000	100 kHz	9.8940 – 10.1060
200 VAC	50.000	400 Hz	49.940 – 50.060
200 VAC	50.000	100 kHz	49.440 – 50.560
1200 VAC	100.000	400 Hz	99.73 – 100.27
1200 VAC	100.000	20 kHz	99.51 – 100.49
AUTO	.10000	10 kHz	.09980 – .10020
AUTO	1.00000	10 kHz	.99890 – 1.00110
AUTO	10.0000	10 kHz	9.9890 – 10.0110
AUTO	100.000	10 kHz	99.890 – 100.110
AUTO	1000.00	10 kHz	996.88 – 1003.12

4-28. Ohms Verification

4-29. Using the resistor decade, apply the resistance values indicated in Table 4-4, to the 8800A input terminals. Select the range and observe the 8800A display for the proper results.

NOTE

Use four-terminal ohms measurement method.

Table 4-4. OHMS VERIFICATION

RANGE	INPUT	DISPLAY READING	LED INDICATION
20MΩ	10MΩ	9.9797 – 10.0203	20MΩ
2000KΩ	1000KΩ (1MΩ)	999.47 – 1000.53	
200KΩ	100KΩ	99.987 – 100.013	
20KΩ	10KΩ	9.9987 – 10.0013	
2KΩ	1KΩ	.99987 – 1.00013	
200Ω	100Ω	99.970 – 100.030	200Ω
200Ω	10Ω	09.988 – 10.012	200Ω
AUTO	10Ω	09.988 – 10.012	200Ω
AUTO	100Ω	99.970 – 100.030	200Ω
AUTO	1KΩ	.99987 – 1.00013	
AUTO	10KΩ	9.9987 – 10.0013	
AUTO	100KΩ	99.9987 – 100.013	
AUTO	1000KΩ (1MΩ)	999.47 – 1000.53	
AUTO	10MΩ	9.9797 – 10.0203	20MΩ

4-30. CALIBRATION ADJUSTMENTS

4-31. Introduction

4-32. The Model 8800A should be calibrated every 90 days or when ever repairs have been made, in order to maintain the instrument within its rated accuracy. The calibration procedure should be performed under the following environmental conditions: Ambient temperature of 23°C ± 1°C, relative humidity less than 80%. Refer to Table 4-1 for the recommended test equipment. Calibration adjustments are identified on the top inner guard cover. Perform the following preliminary steps before calibrating the instrument.

a. Remove the molded plastic outer cover.

b. Leave the top and bottom inner guard covers in place.

c. Connect the 8800A to the appropriate (115V ac or 230V ac) line power.

d. Turn the instrument on and allow it to warm-up for a minimum of one-half hour.

e. Insure that the ac and dc calibrators are up to their respective operating temperatures.

4-33. Pre-Calibration Procedure

NOTE

Use the 720A with the 332B DC Calibrator to source all voltages below 10 volts.

4-34. The transistors Q14 and Q15, the U1 Op Amp, and the selectable resistors R34 and R38 are matched at the factory. If any one of the five are changed due to calibration requirements or failure the selectable Offset Voltage Correction Resistor procedures outlined in paragraph 4-43 must be performed.

4-35. ZERO ADJUST

a. Short the two INPUT terminals together.

b. Select the VDC function and 200 mV range.

c. Adjust the front panel DC ZERO adjust for an 8800A display of 00.000 ±1 digit.

4-36. BIAS ADJUST

a. Place a 1 megohm resistor and 0.1 μF cap. across the input terminals.

b. Adjust BIAS adjust (R30) for an 8800A display of 00.000 ±3 digits.

NOTE

The bias adjustment may cause a change in the zero adjustment. Repeat the zero adjust and bias adjust until no further change in the zero adjustment occurs.

4-37. Final Calibration Procedure

4-38. DCV FINAL CAL

a. Select the 2V range; DCV function.

b. Alternately apply +1.0 mV and −1.0 mV to the input terminals and adjust the MASTER OFFSET (R78) for the same absolute number (s) in both polarities.

c. Apply +1 mV to the input terminals and adjust DIFF OFFSET (R88) for exactly +.00100 on the 8800A display.

NOTE

Occasional flashing of +.00101 or +.00099 is acceptable.

d. Short the input terminals.

e. Select the 200 mV and rezero the instrument if necessary.

f. Remove the short. Verify steps a through c.

g. Select the 2V range.

h. Apply +1.00000V and adjust +1V CAL (R99) for an 8800A display of +1.00000 ±1 digit.

i. Increase the input to +1.90000V; Display must be within ±3 digits.

j. Repeat steps h and i using a negative input and adjust −1V CAL (R97).

k. Apply the inputs listed in Table 4-5 to the 8800A on the 2V range, DCV function and note that all display readings are within one digit of the applied voltage.

Table 4-5. DCV LINEARITY CHECK

INPUT	DISPLAY
± .00100 V	± .00100 ± 1 digit
± .01000 V	± .01000 ± 1 digit
± .10000 V	± .10000 ± 1 digit
± .20000 V	± .20000 ± 1 digit
± .30000 V	± .30000 ± 1 digit
± .40000 V	± .40000 ± 1 digit
± .50000 V	± .50000 ± 1 digit
± .60000 V	± .60000 ± 1 digit
± .70000 V	± .70000 ± 1 digit
± .80000 V	± .80000 ± 1 digit
± .90000 V	± .90000 ± 1 digit
±1.00000 V	±1.00000 ± 1 digit

l. Select the 20V range; DCV function

m. Apply +10.0000V and adjust the 10VDC adjustment (R47) for an 8800A display of +10.0000 ± 1 digit.

n. Apply +100.000 mV to the input terminals.

o. Select the 200 mV range and verify the 8800A display is within ± 4 digits.

p. Repeat step n with a −100.000 mV input.

q. Select the 200V range; DCV function.

r. Apply +100.000 V and adjust 100 VDC adjustment (R21) for an 8800A display of +100.000 ± 1 digit.

s. Select the 1200V range; DCV function.

t. Apply +1000.00V and verify the 8800A display is +1000.00 ± 3 digits.

4-39. AC CONVERTER FINAL CALIBRATION

4-39a. Use the following procedure to adjust the dc offset of the AC Converter:

a. Select the VAC function.

b. Select the 1200V range.

c. Apply a 1 mV ac, 500 Hz signal to the INPUT terminals of the 8800A.

d. Use a Multimeter to measure the dc voltage between the INPUT LO terminal and the collector of Q5 on the AC Converter PCB.

e. Adjust R30 (OFFSET) for a dc voltage reading of +30 mV dc ±3 mV dc.

4-40. The remainder of AC Converter calibration procedure is presented in Table 4-6. Insure that the ac calibrator used to supply the required voltages, is up to its prescribed operating temperature. Install shorting link between HI and LO input terminals. Depress the VAC function switch on the 8800A and proceed with the test.

4-41. OHMS CONVERTER FINAL CALIBRATION

NOTE

Remove the shorting links that connect the two HI terminals together and the two LO terminals together. Use the four-terminal measurement technique (as pictured in Figure 2-2) for this procedure.

a. Select the kΩ function.

b. Apply a 10 MΩ standard resistance (ESI 1063B resistor decade) to the input.

c. Select the 20 MΩ range.

d. Adjust the 10 MΩ cal (R5) for an 8800A display of 10.0000 ±3 digits.

e. Apply a 100 kΩ standard resistance to the input. The display should indicate 0.1000 ±1 digit.

f. Apply a 1 MΩ standard resistance to the input. The display should indicate 1.0000 +7/−4 digits.

g. Select the 2000 kΩ range and adjust the 1 MΩ cal (R6) for an 8800A display of 1000.00 ±1 digit.

h. Apply a 100 kΩ standard resistance to the input. The display should indicate 100.00 ±2 digits.

i. Select the 200 kΩ range.

j. Adjust the 100 kΩ cal (R8) for an 8800A display of 100.000 ±1 digit.

k. Apply a 10 kΩ standard resistance to the input. The display should indicate 10.000 ±1 digit.

l. Select the 20 kΩ range.

Table 4-6. ACV FINAL CAL.

STEP	RANGE	INPUT	FREQ	ADJUST	READING	TOLERANCE
1	1200V	500	500 Hz	R20 (500V/500 Hz)	500.00	± 3 digits
2	1200V	500	10 kHz	C2 (500V/10 kHz)	500.00	± 3 digits
3	1200V	1.0V	500 Hz	—	001.00	± 5 digits
4	2V	1.0V	500 Hz	R6 (1.0V/500 Hz)	1.00000	± 5 digits
5	2V	1.0V	50 Hz	—	1.00000	± 70 digits
6	2V	1.0V	50 kHz	C7 (1.0V/50 kHz)	1.00000	± 20 digits
7	2V	1.0V	20 kHz	—	1.00000	± 30 digits
8 Repeat step 2					500.00	± 3 digits
9 Repeat step 6					1.00000	± 20 digits
10	2V	1.0V	100 kHz	—	1.00000	± 530 digits
11	2V	1.9V	10 kHz	—	1.90000	± 100 digits
12	2V	20 mV	500 Hz	—	.02000	± 5 digits
13	200V	100V	500 Hz	R10 (100V/500 Hz)	100.000	± 5 digits
14	200V	100V	50 kHz	C23 (100V/50 kHz)	100.000	± 50 digits
15	20V	10V	500 Hz	R8 (10V/500 Hz)	10.0000	± 5 digits
16	20V	10V	50 kHz	C9 (10V/50 kHz)	10.0000	± 50 digits
17	1200V	1000V	20 kHz	—	1000.00	± 250 digits

m. Adjust the 10 kΩ cal (R10) for an 8800A display of 10.000 ±1 digit.

n. Apply a 1 kΩ standard resistance to the input. The display should be 1.0000 ±1 digit.

o. Select the 2 kΩ range.

p. Adjust the 1 kΩcal (R13) for an 8800A display of 1.00000 ±1 digit.

q. Apply a 100Ω standard resistance to the input. The display should be .10000 ±1 digit.

s. Select the 200Ω range.

t. Verify that the 8800A display is 100.000 ±6 digits.

u. Select the AUTO pushbutton.

v. Remove the 100Ω resistance and verify that the unit autoranges to the 20 MΩ range.

w. Apply a 100Ω standard resistance to the input, and verify that the unit autoranges to the 200Ω range.

NOTE

Insure the shorting links used to connect the two HI terminals together and the LO terminals together are installed when the Ohm Converter Final Calibration is completed.

4-42. Procedure for Selecting Offset Voltage Correction Resistors

4-43. The following procedures must be performed anytime that Q14, Q15, U1, R34, R35, R38, or R39 are changed during the calibration procedure or troubleshooting. A digital voltmeter with at least 1 microvolt resolution, such as the Fluke 8400A or another 8800A, is required.

4-44. SET-UP

a. Select the 1 VDC range on the test equipment DVM.

b. Connect the LO input to common and the high input to TP13 on the 8800A under test.

c. Mechanically center the Front Panel DC ZERO control.

d. Select the 200 mVDC range on the 8800A under test and short the input terminals.

e. Connect jumpers across the selected resistor positions A and B (R38 and R34, respectively).

f. Maximum allowable reading on the test DVM is ±0.05000. Any reading greater is out of the range of the resistor selection tables and the multi

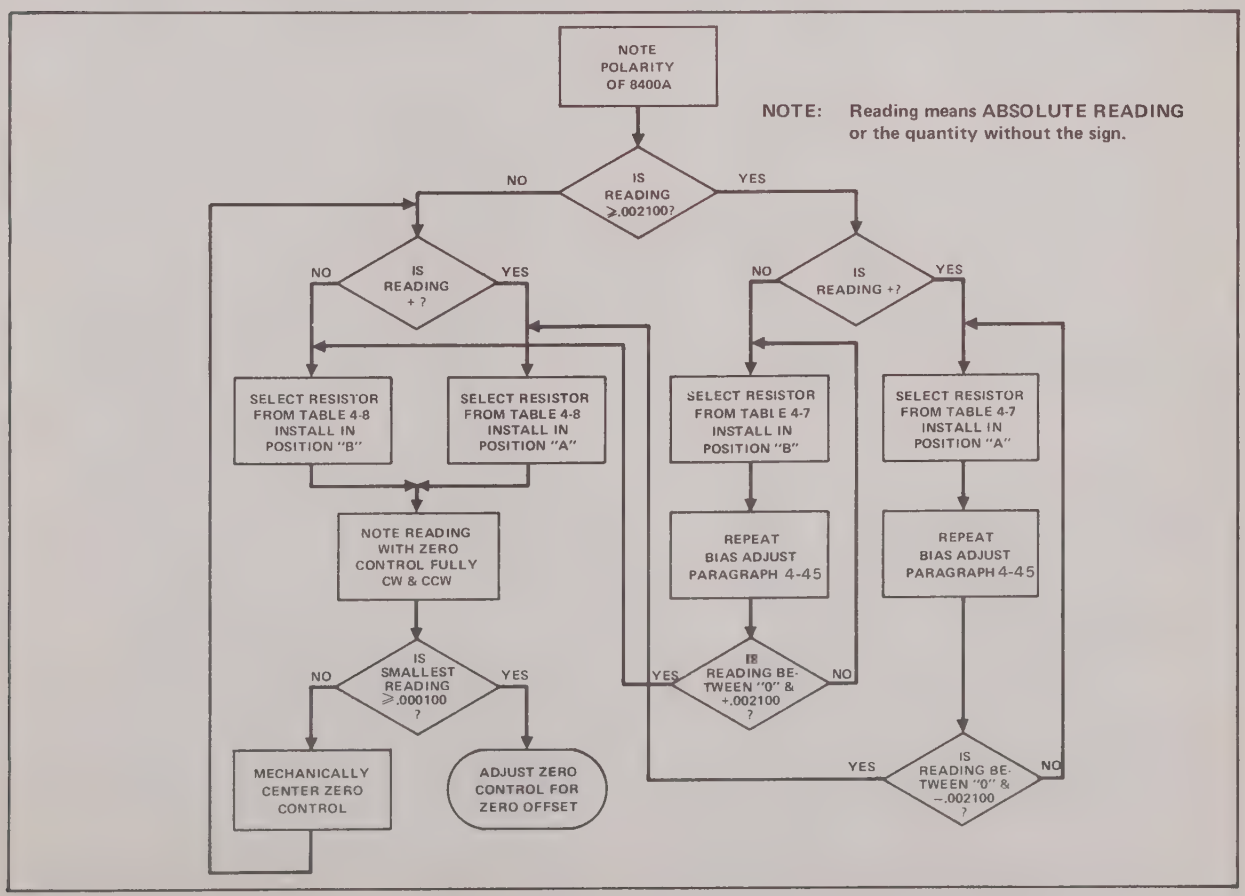

NOTE POLARITY OF 8400A
NOTE: Reading means ABSOLUTE READING or the quantity without the sign.
IS READING ≥.002100?
NO
YES
IS READING + ?
IS READING +?
SELECT RESISTOR FROM TABLE 4-8 INSTALL IN POSITION "B"
SELECT RESISTOR FROM TABLE 4-8 INSTALL IN POSITION "A"
SELECT RESISTOR FROM TABLE 4-7 INSTALL IN POSITION "B"
SELECT RESISTOR FROM TABLE 4-7 INSTALL IN POSITION "A"
NOTE READING WITH ZERO CONTROL FULLY CW & CCW
REPEAT BIAS ADJUST PARAGRAPH 4-45
REPEAT BIAS ADJUST PARAGRAPH 4-45
IS SMALLEST READING ≥.000100 ?
IS READING BETWEEN "0" & +.002100 ?
IS READING BETWEEN "0" & −.002100 ?
MECHANICALLY CENTER ZERO CONTROL
ADJUST ZERO CONTROL FOR ZERO OFFSET

Figure 4-1. OFFSET RESISTOR SELECTION PROCEDURE

Change Notice Yellow Sheet

Table 4-7. OFFSET VOLTAGE CORRECTION RESISTORS (COARSE)

OFFSET VOLTAGE	COARSE RESISTOR	J.F. P/N	TOL. %	TEMPERATURE COEFFICIENT
0.00000 - 0.00200	None	------		
0.00201 - 0.00400	31.6k	261610	1%	T0
0.00401 - 0.00600	47.5k	289546	1%	T0
0.00601 - 0.00800	63.4k	235382	1%	T0
0.00801 - 0.01000	80.6k	281121	1%	T0
0.01001 - 0.01200	95.3k	289561	1%	T0
0.01201 - 0.01400	113 k	379065	1%	T2
0.01401 - 0.01600	130 k	379073	1%	T2
0.01601 - 0.01800	147 k	379081	1%	T2
0.01801 - 0.02000	162 k	379099	1%	T2
0.02001 - 0.02200	178 k	379107	1%	T2
0.02201 - 0.02400	196 k	379115	1%	T2
0.02401 - 0.02600	215 k	379123	1%	T9
0.02601 - 0.02800	232 k	257527	1%	T9
0.02801 - 0.03000	249 k	379131	1%	T9
0.03001 - 0.03200	267 k	379149	1%	T9
0.03201 - 0.03400	287 k	257543	1%	T9
0.03401 - 0.03600	301 k	379156	1%	T9
0.03601 - 0.03800	316 k	379164	1%	T9
0.03801 - 0.04000	340 k	379172	1%	T9
0.04001 - 0.04200	357 k	312793	1%	T9
0.04201 - 0.04400	374 k	379170	1%	T9
0.04401 - 0.04600	392 k	260455	1%	T9
0.04601 - 0.04800	412 k	379198	1%	T9
0.04801 - 0.05000	432 k	379206	1%	T9

Table 4-8. OFFSET VOLTAGE CORRECTION RESISTORS (FINE)

OFFSET VOLTAGE	FINE RESISTOR	J.F. P/N	TOL%	TEMPERATURE COEFFICIENT
0.00000 - 0.00010	None	------		
0.00011 - 0.00030	1.54k	289066	1%	T0
0.00031 - 0.00051	3.09k	235150	1%	T0
0.00051 - 0.00071	4.75k	260679	1%	T0
0.00071 - 0.00091	6.19k	283911	1%	T0
0.00091 - 0.00110	7.68k	370999	1%	T0
0.00110 - 0.00130	9.31k	379040	1%	T0
0.00131 - 0.00150	10.7k	293613	1%	T0
0.00151 - 0.00170	12.4k	261644	1%	T0
0.00171 - 0.00191	14.0k	379057	1%	T0
0.00191 - 0.00210	16.9k	267146	1%	T0

meter must be repaired. Refer to the troubleshooting procedure or return the instrument to an authorized Fluke Service Center.

4-45. BIAS ADJUST

a. Note the reading on the test equipment DVM.

b. Replace the short across the input terminals with a 1MΩ resistor in parallel with a 0.1 μF capacitor.

c. Adjust the BIAS ADJ control for the same reading as noted above, plus or minus five digits.

d. Remove the resistor/capacitor network and reconnect the short.

4-46. OFFSET RESISTOR SELECTION

4-46a. Perform the test outlined in Figure 4-1 (Resistor Selection Procedure).

4-47. Buffer Amplifier Common Mode Rejection Ratio Test

a. Select the 20V DC range on the 8800A under test.

b. Connect the test equipment DVM LO input to the HI terminal of the 8800A under test.

c. Connect the test equipment DVM HIGH to TP6 on the 8800A under test.

d. Short the input terminals on the 8800A under test and note the readings.

e. Apply +21 volts DC ±21 mV to the 8800A under test.

f. The display on the 8800A under test reads 18.8888 and flashes.

g. The change in the reading on the test equipment DVM is less than 40 microvolts from the value noted in step d. above.

h. Repeat steps e. thru g. applying −21 volts ±21 mV.

i. If the 8800A under test is out of tolerance (a variation in excess of 40 μV), the instrument is in need of repair. Refer to the paragraphs on Troubleshooting or return the instrument to your nearest Fluke Service Center.

4-48. TROUBLESHOOTING

4-49. The information given in the following paragraphs is provided to assist in isolating malfunctions in the 8800A. Before troubleshooting the instrument, however, it should be verified that the cause for the malfunction is actually in the instrument and not caused by faulty external equipments or improper control setting. For this reason, the performance test (paragraph 4-19) is suggested as the first step in troubleshooting. The performance test may also help to localize the trouble to a particular section of the instrument.

4-50. The following reminders of basic fault isolation will help determine if the cause is the result of an internal malfunction or faulty external connection.

a. Carefully check the 8800A control settings: some false indications may be caused by an incorrect or overlooked control setting.

b. Check associated equipment: insure the associated equipment controls and connections are correct.

c. Carefully inspect the interior of the instrument: check for physically damaged parts, loose or broken wires and improperly seated plug-in assemblies.

4-51. When it is determined, by the above checks, that the malfunction is within the 8800A, the following procedure can be used to isolate the problem area. The recommended test equipment for troubleshooting is listed in Table 4-1.

4-52. Power Supply Check

4-53. Incorrect output voltages from any of the power supplies may cause the multimeter to exhibit various improper indications. The power supply voltages should be checked in the event of any instrument malfunction. Use the following procedure to check the voltage output of each power supply. Figure 4-2 illustrates where the connections are to be made for checking each supply.

a. Connect the test equipment voltmeter common lead in INPUT LO terminal.

b. Connect the test equipment voltmeter high input lead to TP7 (+18 volt supply). The supply output should be +18.02 ±0.05 volts.

c. Connect the test equipment voltmeter high input lead to TP8 (−18 volt supply). The supply output should be −18.02 ±0.10 volts.

d. Connect the test equipment voltmeter high input lead to the positive end of C18 (+35 volt supply). The supply output should be +35.0 ±5.0 volts (at 115V ac line voltage).

e. Connect the test equipment voltmeter high input lead to the negative end of C19 (−35 volt supply). The supply output should be −35.0 ±5.0 volts (at 115V ac line voltage).

f. Connect the test equipment voltmeter high input lead to TP9 and low input to TP8. The voltmeter should indicate +5.0 ±0.2 volts.

4-54. The +18 volt, +7 volt supplies all share a common reference provided by U9. The −18 volt supply receives operating dc voltage from the +18 volt supply. Problems occuring in one supply may cause improper operation of the others. The following procedure provides for open loop operation of the supplies to aid in localizing the defective supply.

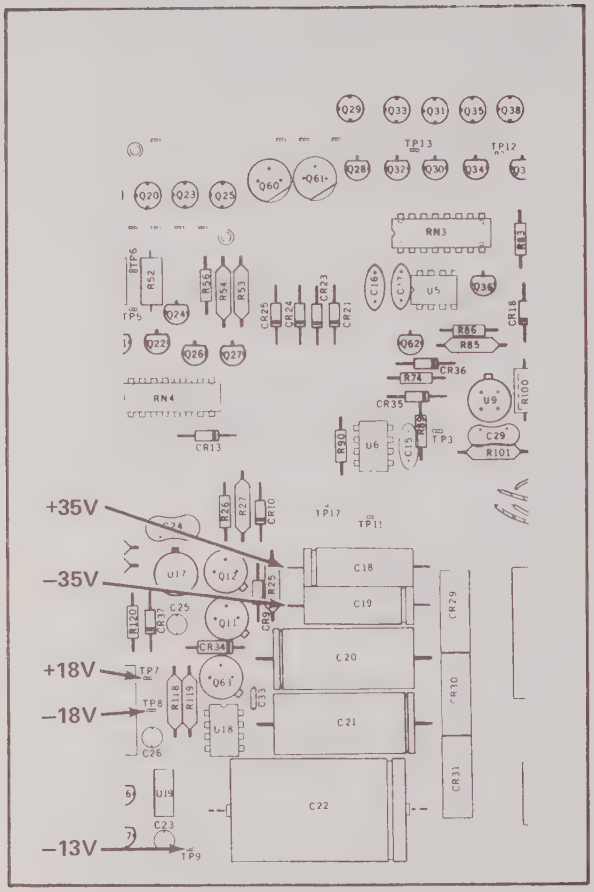


Figure 4-2. POWER SUPPLY VOLTAGE CHECK

a. Unsolder and lift one end of R120.

b. Short pins 3 and 4 of U17 together. This will utilize the internal reference of U17 for control.

c. Check the voltage outputs of the +18 volt supply, TP7 (this supply may be out of prescribed tolerance limits because of the change to the U17 internal reference), +7 volt supply TP11, –7 volt supply TP10 and –18 volt supply TP8.

d. Repair the faulty supply.

e. When all supplies are operating properly, remove the short from U17 pins 3 and 4, reconnect R120 and check the supplies for operation within specifications stated in Paragraph 4-50.

4-55. Integrated Circuit Replacement

4-56. CMOS and PMOS type integrated circuits require special handling whenever the IC is not installed in the circuit. This type integrated circuit can be destroyed by static electricity discharge. To prevent damage due to static discharge, the following precautions should be taken whenever IC's U13, U14, U15 or U20 on the main pcb or any IC on the DOU (–02 option) is handled.

a. The PMOS or CMOS integrated circuit leads are imbedded in conductive foam. Do not remove the conductive foam from the integrated circuit until ready for installation into the unit.

b. Be sure the repairing personnel and the unit under repair are commonly grounded before the integrated circuit is put in place in the unit.

c. Be sure the soldering iron used is grounded to the common ground of the unit under repair.

4-57. Fault Area Isolation

4-58. A malfunction in the 8800A may be isolated to a particular section of circuitry by observing the displayed symptoms during the multimeter operation in each function. The results of the Performance Tests (paragraph 4-19) will indicate the multimeter functions affected by the malfunction. The problem areas, indicated by the various improper functional displays, are presented in Table 4-9. Four vertical columns, describing the 8800A operational status in each of the three functions as being either proper or improper, indicate the functional area of the multimeter where the problem is most likely to be found. Close observation of the symptoms displayed on the front panel coupled with a knowledge of the theory of operation (Section 3) may further define the problem area.

4-59. Troubleshooting information for each functional area is presented in the following paragraphs. Proceed to the paragraphs that provide the troubleshooting information for the problem area indicated by the fault area isolation procedure. Keep in mind, however, that a malfunction within one functional area may affect the operation of another.

4-60. AC CONVERTER

4-61. Generally a failure in the AC Converter will do one of two things: 1) create a dc voltage output without an ac input signal applied or 2) not produce the proper dc voltage for the A/D Converter when an ac input signal is applied. A dc output generated by the AC Converter will cause the multimeter display to indicate some value of ac voltage, in the two highest ranges, when a short is placed across the input terminals. When the AC Converter failure causes the display to remain at zero when an ac

Table 4-9. PROBLEM AREA ISOLATION

8800A FUNCTION	8800A OPERATION IN EACH FUNCTION IS –			
DC V AC V OHMS	PROPER IMPROPER PROPER	IMPROPER PROPER IMPROPER	PROPER PROPER IMPROPER	IMPROPER IMPROPER IMPROPER
PROBLEM AREA INDICATED	AC CONVERTER	VDC BUFFER	OHM CONVERTER	A/D CONVERTER OR CONTROL AND DISPLAY

signal is applied to the input, the converter is not producing the proper dc voltage output for the A/D Converter.

4-62. The following procedure should be used when troubleshooting those failures that cause an apparent offset voltage from the AC Converter.

a. Remove the molded plastic outer cover and top guard cover from the 8800A. (See paragraph 4-7 Access/Disassembly)

b. Remove the Ohms Converter pcb to provide room for troubleshooting the AC Converter. This does not affect the ac operation of the instrument.

c. Connect the 8800A to ac line power, turn the unit on, and select the VAC function and 2 volt range.

d. Connect the Low input lead of a test equipment multimeter to the 8800A INPUT - Ω SENSE LO terminal and the high lead to J5 pin 10 (AC Converter output).

e. Short the 8800A input high to low terminals.

f. The dc voltage output at J5 pin 10 should be close to zero volts dc.

4-49. A dc voltage output at J5 pin 10 of more than approximately 100 mV, either positive or negative, indicates a failure within the AC Converter. A converter output voltage of two volts dc or greater will cause the 8800A display to read full scale (a flashing display of 188888). Improper output voltage levels approximately equal to the +18 volt or –18 volt supply are generally caused by failures of Q1, Q2, CR6, U1, or there associated components. Lower level offsets are generally caused by feedback loop failures. Improper operation of Q4, Q5, Q6, or associated components would not only cause a zero offset but would also add the value of that offset to all ranges of ac voltage measurements.

4-64. When the AC Converter failure causes the 8800A display to indicate zero volts when ac inputs are applied to the instrument use the following procedure to locate the malfunction.

a. Remove the molded plastic outer cover and top guard cover from the 8800A. (See paragraph 4-7 Access/Disassembly)

b. Remove the Ohms Converter pcb to provide room for troubleshooting the AC Converter. This does not affect the ac operation of the instrument.

c. Connect the 8800A to ac line power, turn the unit on and select the VAC function and 2 volt range.

d. Connect the signal return of an oscilloscope to the LO INPUT terminal and the input probe to the connection at either end of the red and white AC Converter input wire.

e. Apply a one volt rms sinusoidal 10 kHz signal to the 8800A input terminals.

f. Note the oscilloscope trace (amplitude and frequency).

g. Move the oscilloscope input probe to the junction point of R17 and R18.

h. The oscilloscope trace should be approximately one-quarter of the input signal amplitude and 180° out-of-phase.

i. If this signal is not correct move the oscilloscope input probe to the junction point of CR3 and the emitter of Q2.

j. The oscilloscope trace should be as described in step h.

4-65. If the wave forms are correct at both points, the probable cause for the lack of an AC Converter output would be a shorted C16 or C17, or an open Q7. Incorrect wave form; asymmetrical, distorted, or of wrong amplitude, can generally be attributed to improper operation of Q1, Q2, CR6 or U1.

4-66. VDC BUFFER

4-67. The 8800A front panel display will generally indicate a buffer malfunction in one of three ways. First, the display presents an over range indication (flashing +188888) for all inputs applied to the instrument. Second, the display will not indicate any applied dc input; producing a displayed readout of 000000 plus two or three digits of noise. Third, the display indicates that some value of offset if being added to all inputs. This offset malfunction will usually produce a display indication even without an input applied to the instrument.

4-68 Malfunctions within the VDC Buffer may cause the display to be improper on one or two ranges and correct on the others. The overall gain of the buffer is changed for each range. Table 4-10 lists the five dc voltage ranges and the components that control the circuit configuration to produce the proper gain for each range. Noting the range or ranges affected by the malfunction may point to the gain control component or associated circuitry causing the problem.

4-69. If the VDC Buffer malfunction affects all ranges, the following procedure will help isolate the problem. Remove the 8800A outer cover and top guard cover. Select the VDC function and 2V range for this test.

a. Place a short across the 8800A input terminals.

b. Short TP4 and INPUT LO. This will prevent the bootstrap amplifier (U2 and Q16) from driving the buffer into saturation.

c. Using the test equipment multimeter check the voltage drop across CR11, then CR12. The voltage drop should be approximately 6.2V dc each. If the voltage drop is significantly higher or lower across one diode the positive supply (CR9, Q11) or negative supply (CR10, Q12) may be defective.

d. Connect the test equipment multimeter low input to the LO INPUT terminal and the high input to TP6. The voltage level should be about zero. Any voltage present, which cannot be zeroes by the front panel control, is being caused by a malfunction with U1, Q14, Q13, Q15 or associated circuitry.

e. If the voltage level at TP6 is zero, remove the short from the 8800A input terminals and apply +0.2 volts dc to the input. TP6 should provide a +0.2V dc indication also. TP6 should track any change in the input up to about 0.5V dc. Any failure of TP6 to track the input is being caused by U1, Q14, Q13, Q15 and associated circuitry or a short through Q10 or CR6.

f. If all the above indications are correct, the probable cause of the malfunction is Q16, U2, or associated circuitry.

Table 4-10. VDC BUFFER GAIN CONTROL

RANGE	Q18	Q25	Q23	Q20	K5	TOTAL BUFFER GAIN
200 mV	open	closed	open	closed	open	10
2 V	closed	closed	open	open	open	1
20 V	closed	open	closed	open	open	.1
200 V	closed	closed	open	open	closed	.01
1200V	closed	open	closed	open	closed	.001
	Q18, closes to provide a gain of one across Q14, Q15 & U1	Q25, closes to present full buffer output to A/D	Q23, closes to divide the buffer output by 10	Q20, closes to increase the gain of Q14, Q15 & U1 by 10	K5, closes to divide the buffer input by 100	

4-70. OHMS CONVERTER

4-71. Use the following procedure when troubleshooting malfunctions within the Ohms Converter. Remove the 8800A from the outer case. Remove the top inner guard cover. Select the kΩ function and the 200Ω range.

a. Connect a one ohm resistor across the Ω source terminals.

b. Measure the voltage drop across the one ohm resistor. The ohms converter should supply enough current to develop 1 ±0.3mV across the resistor.

c. If the voltage across the resistor is less than 0.8 mV short across Q2 emitter to collector. The voltage across the resistor should now be 0.8 mV or greater. If it is Q21, Q1, Q2 or CR12 is causing the malfunction.

d. Overrange indications in the ohms function can be caused by a failure of Q6 to close and apply the reference voltage to the A/D Converter. Q6 may either be open or the gate signal may not be present during the read period.

e. Select the 10k range

f. Measure the voltage drop across R29. The inverter should supply enough current to develop -6.7 V ±0.2 mV across R29.

g. If the voltage is less than -6.5 V the problem is contained within the inverter, Q24, Q25, or the clock input, which should be 1 MHz.

h. If the inverter checks out, test the voltage dropped across R26. The voltage across R26 should be -2.5V ±0.5. If the voltage does not meet this spec, then the trouble is contained within the regulator, (Q22, Q23) and their associated component, or Q8, Q6, and Q4).

4-72. A/D CONVERTER OR CONTROL AND DISPLAY

4-73. If the display symptoms observed during the fault area isolation procedure indicate that the problem is either in the A/D Converter or Control and Display the following procedure should aid in locating the faulty component. Because the timing of the control signals used to process the input signal through the A/D Converter and Display circuits is critical to the proper operation of these sections an oscilloscope should be used to make the voltage and signal checks.

4-74. The A/D Converter operation can be checked using the following procedure.

a. Select the VDC function and 2 volt range.

b. Apply +1 volt dc to the 8800A input terminals.

c. Measure the input to the A/D Converter at TP13. The voltage, TP13 high to the INPUT LO terminal, should be 1 volt dc.

NOTE

Connect the oscilloscope external sync. input via a X10 probe to TP16 during the remainder of this procedure. The scope control settings are provided on the wave shape illustration.

d. Connect the scope input to TP1 and return to the INPUT LO terminal. The scope display should be as shown in Figure 4-3.

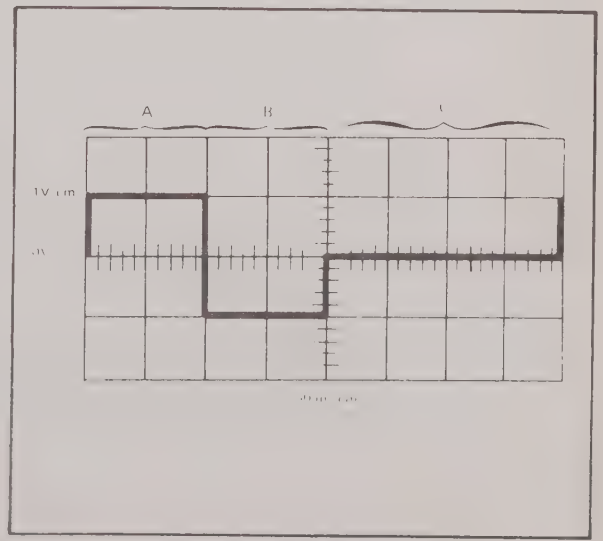


Figure 4-3. TP1 WAVE FORM

4-75. The waveform at TP1 can indicate several possible problems in the circuitry. The 100 ms period designated A is the integrate period during which the unknown 8800A input (in this case 1 volt) is applied to the integrator (Q40 and U4). The 100 ms time designated B is the read period when the reference (in this case −1 volt) is applied to the integrator. The length of period B (read) will change with a change in voltage level applied to the 8800A input within the range selected. The section designated C is the auto-zero period during which the A/D Converter input is shorted to ground, via Q38, to insure that the A/D starts from zero for each new integrate period.

4-76. If the 1 volt input during period A is not present, Q38 may be shorting the input to ground or Q31 may not be closing to apply the buffer output to the A/D. Time period B may indicate that the reference is low by not going to −1 volt. A low reference supply would also cause period B to legthen. If the voltage level during time period B is unstable, the reference supply input FET Q35 or control Q34 may be faulty.

4-77. If the wave form at TP1 presents the proper 100 ms +1 volt indication during A then drops to −1 volt at the start of B but remains at −1 volt through C, the A/D Converter may not be supplying the control IC (U11) with the compare signal (CM). The compare signal can be checked at TP17 using the following procedure.

a. Connect the oscilloscope input to TP17.

b. The scope presentation shown in Figure 4-4 represents the proper compare signal for an 8800A input of +1 volt dc.

c. If this signal is present at TP17, proceed to control signal troubleshooting paragraph 4-79.

d. If the compare pulse is not present or incorrect, either in amplitude or timing of the leading edge make the following check.

e. Move the oscilloscope input to TP2. The scope presentation should be as shown in Figure 4-5.

4-78. The probable cause for an improper signal at TP2 would be a failure in Q40 or U4. If the voltage level remains at zero volts the protection transistor Q59 or Q64 may be shorted or input FET Q39 open.

4-79. The timing signals that control the processing of inputs applied to the 8800A are developed within the custom I.C., U11. A 1 MHz crystal (Y1) provides the base frequency from which the timing control signals are produced. Figure 4-6 illustrates the timing relationship between the control signals (INT., DE(+R), AZ, and △2), as they appear at RN3, and the integrator signal at TP2. An incorrect or missing control signal at RN3 may be caused by a failure in the logic control gates U13, U14, or U15.

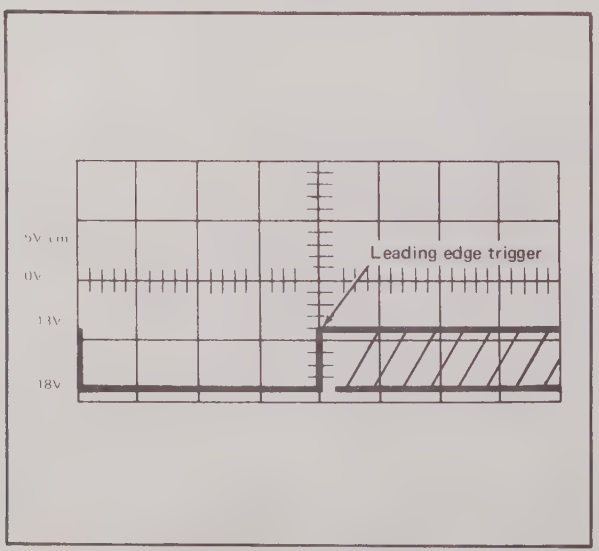


Figure 4-4. TP17 COMPARE SIGNAL

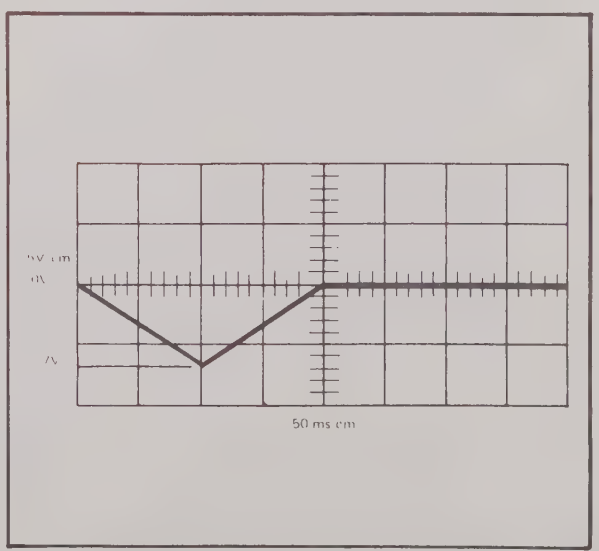


Figure 4-5. A/D INTEGRATOR OUTPUT

4-80. The logic control gates (U13, U14, and U15) and the custom integrated circuit U11 use the 5 volt difference in potential between the −18 volt supply and −13 volt supply for the logic control signal levels. The recommended method for observing the logic signals in this area is to attach the oscilloscope return to the INPUT LO terminal and watch the logic signals for level changes between −18 volt and −13 volt levels.

CAUTION

The oscilloscope return has been connected to the INPUT LO terminal for the waveform checks. For observation of the control signals on the pins of U11 or logic control gates (U13, U14, and U15) the oscilloscope return can be connected to TP8, the −18 volt supply. If this connection is made insure that the oscilloscope return will not ground the −18 volt power supply. Damage to the 8800A circuitry WILL result from grounding TP8.

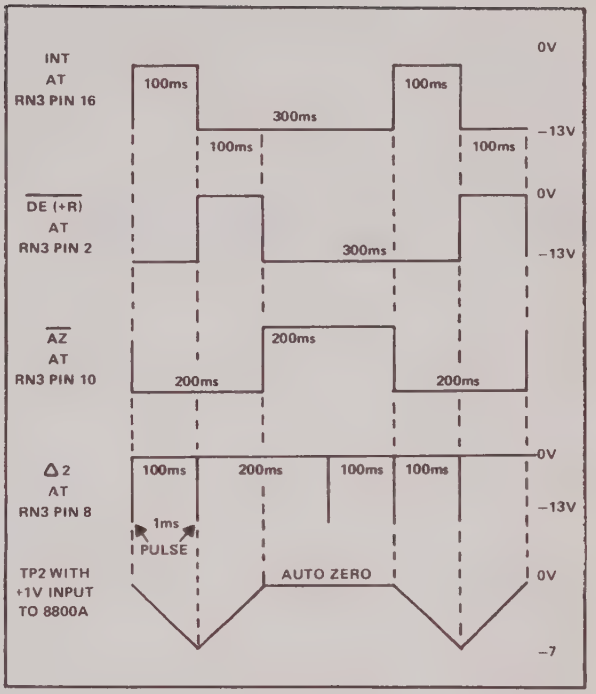


Figure 4-6. A/D CONVERTER CONTROL SIGNAL TIMING

Section 5
List of Replaceable Parts

TABLE OF CONTENTS

ASSEMBLY NAME	DRAWING NO.	TABLE NO.	TABLE PAGE	FIGURE NO.	FIGURE PAGE
Final Assembly	8800A	5-1	5-3	5-1	5-5
A1 Main PCB Assembly	8800A-4001T	5-2	5-7	5-2	5-13
A2 Front Panel Assembly	8800A-4451	5-3	5-14	5-3	5-15
A2A1 Display PCB Assembly	8800A-4002T	5-4	5-16	5-4	5-17
A3 Ohms Converter PCB Assembly	8800A-4010T	5-5	5-18	5-5	5-21
A4 AC Converter PCB Assembly	8800A-4014T	5-6	5-22	5-6	5-24

5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the instrument. A similar parts listing for each of the Options will be found in Section 6. Components are listed alphanumerically by assembly. Both electrical and mechanical components are listed by reference designation. Each listed part is shown in an accompanying illustration.

5-3. Parts lists include the following information:

1. Reference Designation.
2. Description of each part.
3. FLUKE Stock Number.
4. Federal Supply Code for Manufacturers. (See Section 7 for Code-to-Name list.)
5. Manufacturer's Part Number.
6. Total Quantity of components per assembly.
7. Recommended Quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of 2 years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for 1 year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked (see paragraph 5-7). In the case of optional subassemblies, plug-ins, etc., that are not always part of the instrument, or are deviations from the basic instrument model, the REC QTY column lists the recommended spares quantity for the items in that particular assembly.

5-4. HOW TO OBTAIN PARTS

5-5. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. or its authorized representatives by using the FLUKE STOCK NUMBER. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-6. To ensure prompt and efficient handling of your order, include the following information.

1. Quantity.
2. FLUKE Stock Number.
3. Description.
4. Reference Designation.
5. Printed Circuit Board Part Number and Revision Letter.
6. Instrument Model and Serial Number.

5-7. A Recommended Spare Parts Kit for your basic instrument is available from the factory. This kit contains those items listed in the REC QTY column of the parts list in the quantities recommended.

5-8. Parts price information is available from the John Fluke Mfg. Co., Inc. or its representatives. Prices are also available in a Fluke Replacement Parts Catalog, which is available on request.

CAUTION

Indicated devices are subject to damage by static discharge.

Table 5-1. FINAL ASSEMBLY

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	⊗ FINAL ASSEMBLY FIGURE 5-1 (8800A-T&B/5001)	8800A					
A1	MAIN PCB ASSEMBLY	366245	89536	366245	1		
A2	FRONT PANEL ASSEMBLY	372391	89536	372391	1		
A3	OHMS CONVERTER PCB ASSEMBLY	456103	89536	456106	1		
A4	AC CONVERTER PCB ASSEMBLY	462846	89536	462846	1		
F1	FUSE, LINE POWER (INCLUDES SPARE)				2	10	
	1/4 AMP, 250V FOR 120V AC	109314	71400	AGC 1-4			
	1/8 AMP, 250V FOR 230V AC	196790	71400	AGC 1-8			
H1	SCREW, 6-20 X 3/8	288266	89536	288266	2		
H2	WASHER, FLAT	340505	89536	340505	2		
H3	SCREW, 6-20 X 5/8	386656	89536	386656	2		
H4	SCREW, 6-32 X 3/16	381087	89536	381087	4		
H5	SCREW, METRIC 6MM	380626	89536	380626	2		
H6	SCREW, 4-40 X 1/4	114884	89536	114884	4		
H7	SCREW, 6-32 X 1/4	385799	89536	385799	4		
H8	SCREW, 4-40 X 5/16	152116	89536	152116	2		
H9	SCREW, 6-32 X 1/4	178533	89536	178533	1		
H10	SCREW, 4-40 X 1/4	185918	89536	185918	5		
H11	NUT, CHASSIS	364737	89536	364737	2		
H12	WASHER, FLAT	381749	89536	381749	1		
H13	WASHER, LOCK #3	110783	89536	110783			
MP1	CASE, FINISHED	496620	89536	496620	1		
MP2	CHASSIS, SIDE ASSEMBLY	372227	89536	372227	1		
MP3	CHASSIS, SIDE	388264	89536	388264	1		
MP4	CRANK AND ROD ASSEMBLY	378968	89536	378968	1		
MP5	DECAL HANDLE, MOLDED	347401	89536	347401	2		
MP6	DECAL, GEN. SPEC	380402	89536	380402	1		
MP7	E RETAINING RING	168914	79136	5133-15-MDR	1		
MP8	GUARD, BOTTOM (NOT ILLUSTRATED)	364901	89536	364901	1		
MP9	GUARD, INSULATOR (TOP & BOTTOM)	384289	89536	384289	2		
MP10	GUARD, TOP	462812	89536	462812	1		
MP11	GUARD, XFMR	365114	89536	365114	1		

Table 5-1. FINAL ASSEMBLY (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
MP12	HANDLE, MOLDED	414581	89536	414581	1		
MP13	LENS, SCREENED	401604	89536	401604	1		
MP14	IEE POWER SWITCH	380121	89536	380121	1		
MP15	PAD, FOOT	338632	89536	338632	1		
MP16	DECAL, 100V POWER (NOT ILLUSTRATED)	353623	89536	353623	AR		
MP17	HEAT SINK	421024	89536	421024	1		
MP18	RETAINING RING	355586	89536	355586	1		
MP19	SPACER	375220	89536	375220	1		
MP20	SPACER, TEFLON	381772	89536	381772	1		
MP21	BRACKET, REAR SUPPORT	384297	89536	384297	1		
MP22	LINE CORD (NOT ILLUSTRATED)	343723	89536	343723	1		
T1	TRANSFORMER (ORDER OPTIONAL VOLTAGE)				1		
	100 VOLT	395194	89536	395194			
	115/230 VOLT	373977	89536	373977			
TM1	INSTRUCTION MANUAL	369405	89536	369405	AR		
U11	IC, UNIVERSAL DVM, LSI	407734	89536	407734	1	1	
XF1	FUSEHOLDER	103283	71400	4405	1		
	RECOMMENDED SPARE PARTS LIST	345298	89536	345298	AR		

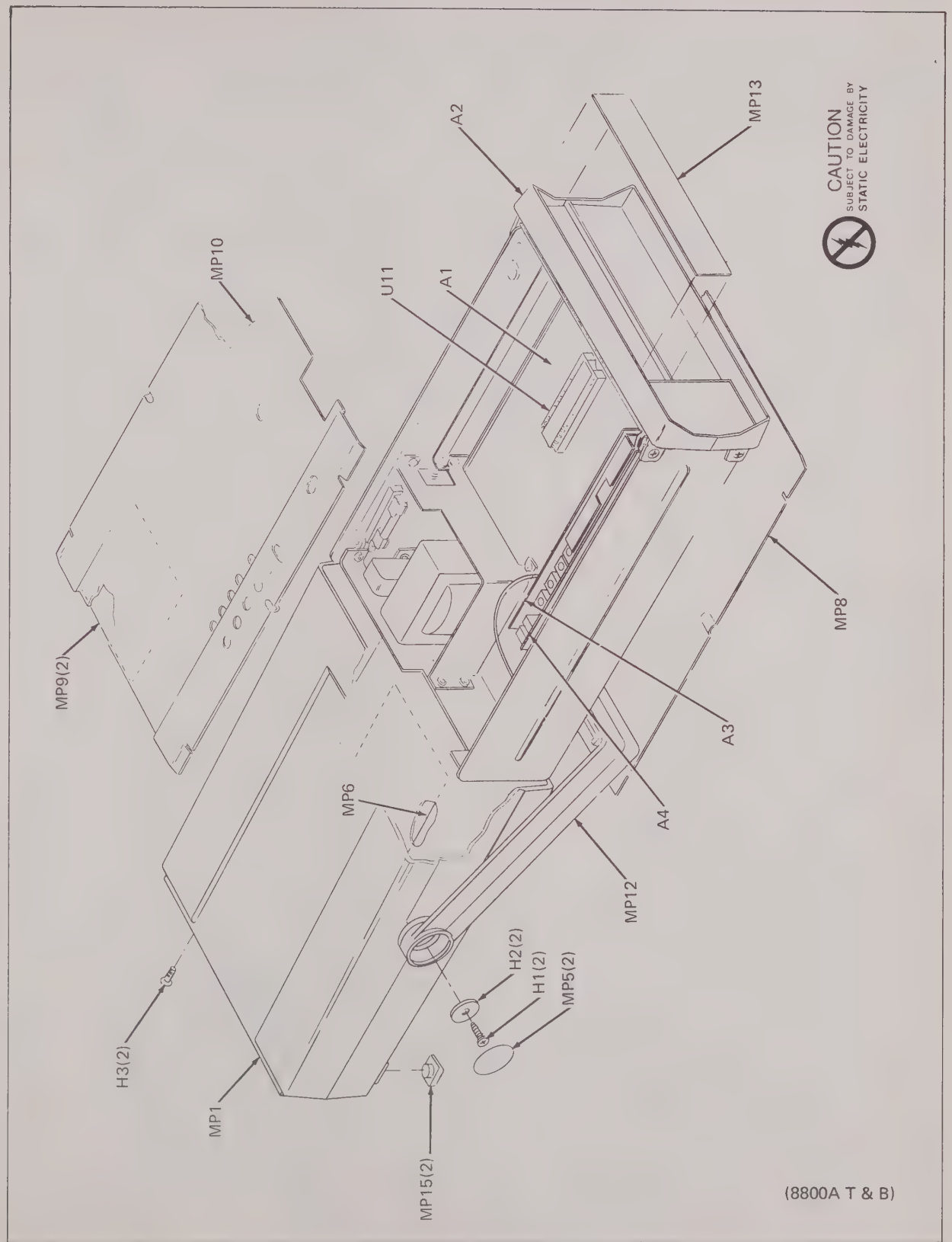


Figure 5-1. FINAL ASSEMBLY

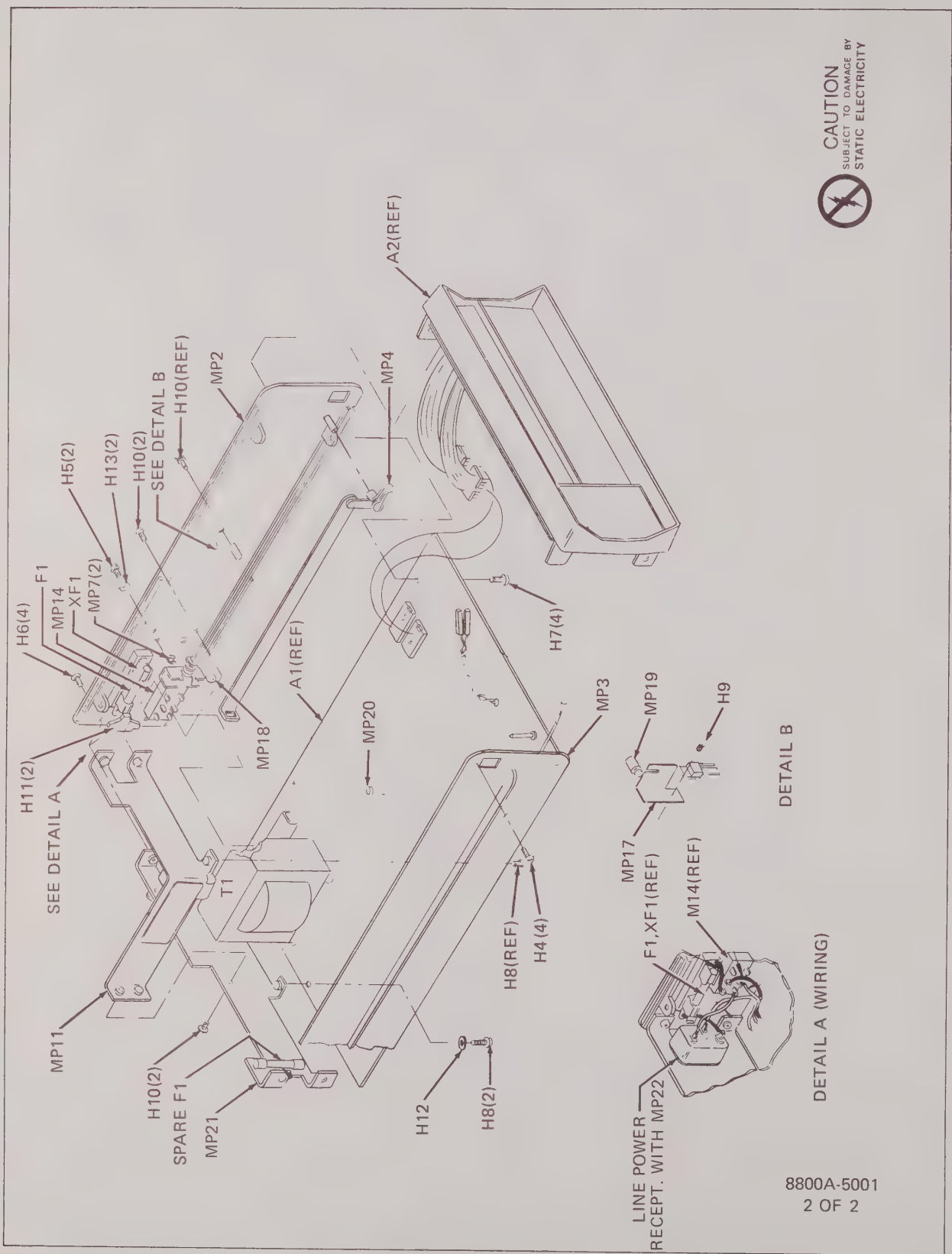


Figure 5-1. FINAL ASSEMBLY (cont)

Table 5-2. A1, MAIN PCB ASSEMBLY

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1	⊗ MAIN PCB ASSEMBLY FIGURE 5-2 (8800A-4001T)	366245	89536	366245	REF		
C1	CAP, PLSTC, 0.022 UF +/-10%, 100V	333823	84411	863UW22391	1		
C3	CAP, CER, 0.0005 UF +/-20%, 50V	175232	56289	C023B101E502M	2		
C4	CAP, CER, 0.0005 UF +/-20%, 50V	175232	56289	C023B101E502M	REF		
C5	CAP, MICA, 150 PF +/-5%, 500V	148478	72136	DM15F151J	4		
C6	CAP, MICA, 150 PF +/-5%, 500V	148478	72136	DM15F151J	REF		
C7	CAP, CER, 33 PF +/-2%, 100V	354852	32897	8121A100C0G330G	5		
C8	CAP, POLY CAR, 0.10 UF +/-10%, 100V	376251	73445	C280MCH/A100K	1		
C9	CAP, POLY PROP, 0.47 UF +/-5%, 50V	364042	01281	JF78B	1		
C10	CAP, MICA, 150 PF +/-5%, 500V	148478	72136	DM15F151J	REF		
C11	CAP, CER, 33 PF +/-2%, 100V	354852	32897	8121A100C0G330G	REF		
C12	CAP, MICA, 150 PF +/-5%, 500V	148478	72136	DM15F151J	REF		
C13	CAP, POLY CAR, 2.2 UF +/-10%, 250V	306522	73445	C280MCH/A2M2	1		
C15	CAP, CER, .0012 UF +/-10%, 500V	106732	71590	CF122	1		
C16	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	2		
C17	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C18	CAP, ELECT, 50 UF +75/-10%, 50V	105122	56289	30D506G050DD4	2	1	
C19	CAP, ELECT, 50 UF +75/-10%, 50V	105122	56289	30D506G050DD4	REF		
C20	CAP, ELECT, 220 UF +50/-10%, 40V	178616	73445	ET221X040A01	2	1	
C21	CAP, ELECT, 220 UF +50/-10%,	178616	73445	ET221X040A01	REF		
C22	CAP, ELECT, 4000 UF +100/-10%, 10V	330761	25088	B41010-4700/10	1	1	
C23	CAP, TA, 4.7 UF +/-20%, 20V	161943	56289	196D475X0025JA1	3		
C24	CAP, MICA, 100 PF +/-5%, 500V	148494	72136	DM15F101J	1		
C25	CAP, TA, 4.7 UF +/-20%, 20V	161943	56289	196D475X0025JA1	REF		
C26	CAP, TA, 4.7 UF +/-20%, 20V	161943	56289	196D475X0025JA1	REF		
C27	CAP, CER, 33 PF +/-2%, 100V	354852	32897	8121A100C0G330G	REF		
C28	CAP, CER, 33 PF +/-2%, 100V	354852	32897	8121A100C0G330G	REF		
C29	CAP, MICA, 270 PF +/-5%, 500V	148452	72136	DM15F271J	1		
C31	CAP, MINI CER, 68 PF +/-2%, 100V	362756	80031	222263110689	1		
C32	CAP, MINI CER, 15 PF +/-2%, 100V	369074	80031	222263110159	1		
C33	CAP, CER, 33 PF +/-2%, 100V	354852	32897	8121A100C0G330G	REF		
CR6	DIODE, SI	180554	07910	TD12599	3	1	
CR7	DIODE ZENER, 22V	181073	07910	1N969B	2	1	
CR8	DIODE ZENER, 22V	181073	07910	1N969B	REF		
CR9	DIODE, SI	375485	09214	MPD300	2	1	
CR10	DIODE, SI	375485	09214	MPD300	REF		
CR11	DIODE, ZENER, 6.2V	325811	07910	1N735A	4	1	
CR12	DIODE, ZENER, 6.2V	325811	07910	1N735A	REF		
CR13	DIODE, ZENER, 13V	110726	07910	1N964B	1	1	
CR16	DIODE, SI	203323	07910	1N4148	13	3	
CR18	DIODE, SI	203323	07910	1N4148	REF		

Table 5-2. A1, MAIN PCB ASSEMBLY (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
CR19	DIODE, SI	203323	07910	1N4148	REF		
CR20	DIODE, SI	203323	07910	1N4148	REF		
CR21	DIODE, SI	203323	07910	1N4148	REF	1	
CR22	DIODE, SI	203323	07910	1N4148	REF		
CR23	DIODE, SI	203323	07910	1N4148	REF		
CR24	DIODE, SI	203323	07910	1N4148	REF		
CR25	DIODE, SI	203323	07910	1N4148	REF		
CR26	DIODE, SI	203323	07910	1N4148	REF		
CR29	DIODE, BRIDGE	296509	09423	FB200	3	1	
CR30	DIODE, BRIDGE	296509	09423	FB200			
CR31	DIODE, BRIDGE	296509	09423	FB200	REF		
CR32	DIODE, SI	203323	07910	1N4148	REF		
CR33	DIODE, SI	203323	07910	1N4148	REF		
CR34	DIODE, ZENER, 10V	113324	07919	1N961A	2	1	
CR35	DIODE, ZENER, 6.2V	325811	07910	1N735A	REF		
CR36	DIODE, ZENER, 6.2V	325811	07910	1N735A	REF		
CR37	DIODE, 2 PELLET	375477	09213	MPD200	1	1	
CR38	DIODE, ZENER, 10V	113324	07919	1N961A	REF		
CR39	DIODE, SI	203323	07910	1N4148	REF		
J1	SOCKET, 16-PIN	276535	23880	TSA2900-16W	3		
J2	SOCKET, 14-PIN	276527	23880	TSA2900-14W	4		
J3	SOCKET, 14-PIN	276527	23880	TSA2900-14W	REF		
K5	RELAY, DPDT	514240	26806	A2-420-12-203	1		
MP1	CONN, POST	376574	00779	5166-333-68	16		
MP2	CONN, POST	379438	00779	8619405	17		
MP3	HEAT SINK, XSTR (TO U5)	370155	05820	204-CB	2		
MP4	HEAT SINK, XSTR	418384	13103	418384	1		
MP5	TERMINAL, FEED THRU	529297	89536	529297	2		
MP6	TRANSIPAD, XSTR (NOT SHOWN)	296319	89536	296319	4		
MP7	RETAINER, STRAP (TO K5)	381624	89536	381624	1		
Q10	XSTR, NPN	168716	12040	ST07154	4	1	
Q11	XSTR, PNP	269076	04713	2N4890	2	1	
Q12	XSTR, NPN	150359	86684	2N3053	1	1	
Q13	XSTR, NPN	168716	12040	ST07154	REF		
Q14	XSTR, SI, NPN	295717	24355	AD81100-17	1	1	
Q15	XSTR, DUAL, NPN	470801	32293	IT531073	1	1	
Q16	XSTR, SI, NPN	218396	04713	2N3904	20	5	
Q18	XSTR, FET, N-CHANNEL	370072	12040	KE4393	4	1	
Q19	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q20	XSTR, FET, N-CHANNEL	370072	12040	KE4393	REF		
Q21	XSTR, SI, NPN	218396	04713	2N3904	REF		

Table 5-2. A1, MAIN PCB ASSEMBLY (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
Q22	XSTR, SI, PNP	195974	04713	2N3906	4	1	
Q23	XSTR, FET, N-CHANNEL	370072	12040	KE4393	REF		
Q24	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q25	XSTR, FET, N-CHANNEL	370072	12040	KE4393	REF		
Q26	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q27	XSTR, SI, PNP	195974	04713	2N3906	REF		
Q28	XSTR, SI, NPN	218396	04713	2N390E4	REF		
Q29	XSTR, FET, N-CHANNEL	343830	89536	343830	6	2	
Q30	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q31	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
Q32	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q33	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
Q34	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q35	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
Q36	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q37	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q38	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
Q39	XSTR, FET	386730	89536	386730	1	1	
Q40	XSTR, FET, DUAL	257501	89536	257501	1	1	
Q41	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
Q42	XSTR, SI, PNP	195974	04713	2N3906	REF		
Q43	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q44	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q45	XSTR, SI, PNP	340026	04713	MPS6563	6	2	
Q46	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q47	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q48	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q49	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q50	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q51	XSTR, SI, PNP	340026	04713	MPS65633	REF		
Q52	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q53	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q54	XSTR, SI, NPN	218396	04713	2N39034	REF		
Q55		340026	04713	MPS6563	REF		
Q56		218396	04713	2N3904	REF		
Q57		218396	04713	2N3904	REF		
Q58		195974	04713	2N3906	REF		
Q59		168716	12040	ST07154	REF		
Q60		203364	07263	2N3638	2	1	
Q61		203364	07263	2N3638	REF		
Q62		218081	04713	MPS6520	1	1	

Table 5-2. A1, MAIN PCB ASSEMBLY (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
Q63	XSTR, PNP	269076	04713	2N4890	REF		
Q64	XSTR, NPN	168716	12040	ST07154	REF		
R21	RES, VAR, 200 +/-10%, 1/2W	275743	89536	275743	1	1	
R23	RES, COMP, 100K +/-5%, 2W	285056	01121	HB1045	1		
R25	RES, MF, 383 +/-1%, 1/8W	375899	91637	MFF1-83830F	1		
R26	RES, CAR, 62K +/-5%, 1/4W	348904	80031	CR251-4-5P62K	1		
R27	RES, MF, 205 +/-1%, 1/8W	325647	91637	MFF1-82050F			
R28	RES, CAR, 220 +/-5%. 1/4W	342626	80031	CR251-45P220E	2		
R29	RES, COMP, 100M +/-10%, 1/2W	190520	01121	EB1071	1		
R30	RES, VAR, 100K +/-10%, 1/2W	369520	89536	369520		1	
R31	RES, MF, 499K +/-1%, 1/8W	268813	91637	MFF1-84993F	1		
R32	RES, CAR, 220 +/-5%. 1/4W	342626	80031	CR251-45P220E	REF		
R33	RES, MF, 309K +/-1%, 1/8W	235283	91637	MFF1-83093F	2		
R35	RES, SET (2 PC) W/R39	290320	89536	290320	1		
R36	RES, MF, 309K +/-1%, 1/8W	235283	91637	MFF1-83093F	REF		
R37	RES, VAR, 10K +/-10%, 1/2W	285171	71450	360S103A	1	1	
R39	RES, SET (PART OF R35)				REF		
R40	RES, MF,2.8M +/-1%, 1/2W	236703	91637	MFF1-22804F	1		
R41	RES, CAR, 10K +/-5%, 1/4W	348839	80031	CR251-45P10K	3		
R42	RES, CAR, 150 +/-5%, 1/4W	343442	80031	CR251-4-5P150E	1		
R43	RES, CAR, 10K +/-5%, 1/4W	348839	80031	CR251-45P10K	REF		
R45	RES, CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P1M	3		
R47	RES, VAR, 20 +/-20%, 1/2W	275727	71450	360T200B	1	1	
R48	RES, SET, 2 PC (W/ R52)	363788	89536	363788	1		
R52	RES, SET, 2 PC (PART OF R48)				REF		
R53	RES, MF, 100K +/-1%, 1/8W	248807	91637	MFF1-81003F	1		
R54	RES, MF, 9.76K +/-1%, 1/8W	241489	91637	MFF1-89761F	1		
R55	RES, COMP, 1.5K +/-5%, 1/4W	148031	01121	CB1525	1		
R56	RES, CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P1M	REF		
R74	RES, CAR, 4.7K +/-5%, 1/4W	348821	80031	CR251-45P4K7	1		
R75	RES, MF, 30.9K +/-1%, 1/8W	235275	91637	MFF1-83092F	1		
R76	RES, COMP, 10M +/-5%, 1/4W	194944	01121	CB1065	1		
R77	RES, MF, 64.9K +/-1%, 1/8W	288530	91637	MFF1-86492F	2		
R78	RES, VAR, 200 +/-10%, 1/2W	285148	71450	360S201A	1	1	
R79	RES, MF, 46.4K +/-1%, 1/8W	188375	91637	MFF1-84642F	1		
R80	RES, MF, 64.9K +/-1%, 1/8W	288530	91637	MFF1-86492F	REF		
R83	RES, CAR, 51K +/-5%, 1/4W	376434	80031	CR251-4-5P51K	1		
R84	RES, MF, 4.99K +/-1%. 1/8W	168252	91637	MFF1-84991F	1		
R85	RES, MF, 200K +/-1%, 1/8W	261701	91637	MFF1-82003F	1		
R86	RES, CAR, 3.3K +/-5%, 1/4W	348813	80031	CR251-45P3K3	1		
R87	RES, CAR, 2.7K +/-5%, 1/4W	386490	80031	CR251-45P2K7	1		

Table 5-2. A1, MAIN PCB ASSEMBLY (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R88	RES, VAR, 5K +/-10%, 1/2W	288282	89536	288282	1		
R89	RES, CAR, 100 +/-5%, 1/4W	348771	80031	CR251-4-5P100E	1		
R90	RES, CAR, 2.2K +/-5%, 1/4W	343400	80031	CR251-45P2K2E	2		
R91	RES, SET (R91 THRU R95, R98)	363804	89536	363804	1		
R92	RES, SET (SEE R91)				REF		
R94	RES, SET (SEE R91)				REF		
R95	RES, SET (SEE R91)				REF		
R96	REF AMP, SET (INCLUDES R102 AND U9)	450080	89536	450080	1	1	
R97	RES, VAR, 20 +/-20%, 1/2W	285114	71450	360S200B	2	1	
R98	RES, SET (SEE R91)				REF		
R99	RES, VAR, 20 +/-20%, 1/2W	285114	71450	360S200B	REF		
R100	RES, SUB MINI, WW, 14K +/-0.1%, .1W	363770	54294	SP21D22-14KB	1	1	
R101	RES, MF, 3.74K +/-1%, 1/8W	272096	91637	MFF1-83741F	1		
R102	REF AMP, SET (SEE R96)				REF		
R103	RES, MF, 6.34K +/-1%, 1/8W	267344	91637	MFF1-86341F	1		
R113	RES, MF, 5.49K +/-0.1%, 1/8W	375873	91637	MFF1-85491B			
R114	RES, MF, 3.48K +/-0.1%, 1/8W	375881	91673	MFF1-83481B	1	3	
R115	RES, MF, 10K +/-1%, 1/8W	168260	91637	MFF1-81002F	1		
R116	RES, CAR, 10K +/-5%, 1/4W	348839	80031	CR25-1-45P10K	REF		
R117	RES, CAR, 1M +/-5%, 1/4W	348987	80031	CR251-45P1M	3		
R118	RES. MF. 10/08K +/-0.1%, 1/8W	346908	89536	346908	2		
R119	RES, MF, 10.08K +/-0.1%, 1/8W	346908	89536	346908	REF		
R120	RES, CAR, 2.2K +/-5%, 1/4W	343400	80031	CR251-45P2K2	REF		
R121	RES, COMP, 6.8K +/-5%, 1/4W	148098	01121	CB6825	1		
RN1	RES, NETWORK	379248	89536	379248	1	1	
RN3	RES, NETWORK	379255	89536	379255	1	1	
RN4	RES, NETWORK	379230	89536	379230	1	1	
RN5	RES, NETWORK	358002	01121	FN260	1	1	
S12	SWITCH, SLIDE, 115/230V	376798	82389	11A437	1	1	
T1	SEE FINAL ASSEMBLY, TABLE 5-1						
TP1 THRU TP17	CONN, POST	379438	00779	8619405	17		
U1	IC, OP AMP	284760	12040	LM308H	2	1	
U2	IC, OP AMP, J-FET, INPUT	448985	89536	448985	1	1	
U3	IC, OP AMP, J-FET, INPUT	381962	12040	SH61140	1	1	
U4	IC, OP AMP	363515	24355	AD301AN	2	1	
U5	IC, OP AMP	329912	12040	LM318H	1	1	
U6	IC, LINEAR, COMPARATOR	352195	32293	LM311PA	1	1	
U7	IC, OP AMP	284760	12040	LM308H	REF		
U8	IC, OP AMP	225961	34333	SG8023	1	1	
U9	REF AMP, SET (SEE R96)				REF		

Table 5-2. A1, MAIN PCB ASSEMBLY (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
U11	SEE FINAL ASSEMBLY, TABLE 5-1						
U12	IC, BCD-TO-DECIMAL DECODER	29342	01295	SN7441	1		
U13	Ⓢ IC, C-MOS, HEX	355214	95303	CD4009A	1	1	
U14	Ⓢ IC, C-MOS, NAND	375147	95303	CD4023AE	1	1	
U15	Ⓢ IC, C-MOS, NAND	355198	95303	CD4011AE	1	1	
U16	IC, TTL, BCD DECODER/DRIVER	340109	01295	SN7447AN	1	1	
U17	IC, LINEAR, VOL REG	313106	07263	U5R7723393	1	1	
U18	IC, OP AMP	363515	24355	AD301AN	REF		
U19	IC, LINEAR, VOL REG	355107	07263	F7805UC	1	1	
U20	Ⓢ IC, C-MOS, MULTIPLEXER	375808	95303	CD4053AE	1	1	
W1	JUMPER WIRE						
W2	WIRE ASSY, BLACK	373779	89536	373779	1		
W3	WIRE ASSY, BLUE	378307	89536	378307	1		
W9	WIRE ASSY, RED	378299	89536	378299	1		
XK5	SOCKET RELAY	376665	12300	27E501	1		
XU11	SOCKET, 40 PIN	376244	23880	TSA3100-40W	1		
XU13	SOCKET, 16 PIN	276535	23880	TSA2900-16W	REF		
XU14	SOCKET, 14 PIN	276527	23880	TSA2900-14W	REF		
XU15	SOCKET, 14 PIN	276527	23880	TSA2900-14W	REF		
XU20	SOCKET, 16 PIN	276535	23880	TSA2900-16W	REF		
Y1	CRYSTAL, QUARTZ, 1 MHZ	375493	89536	375493	1		

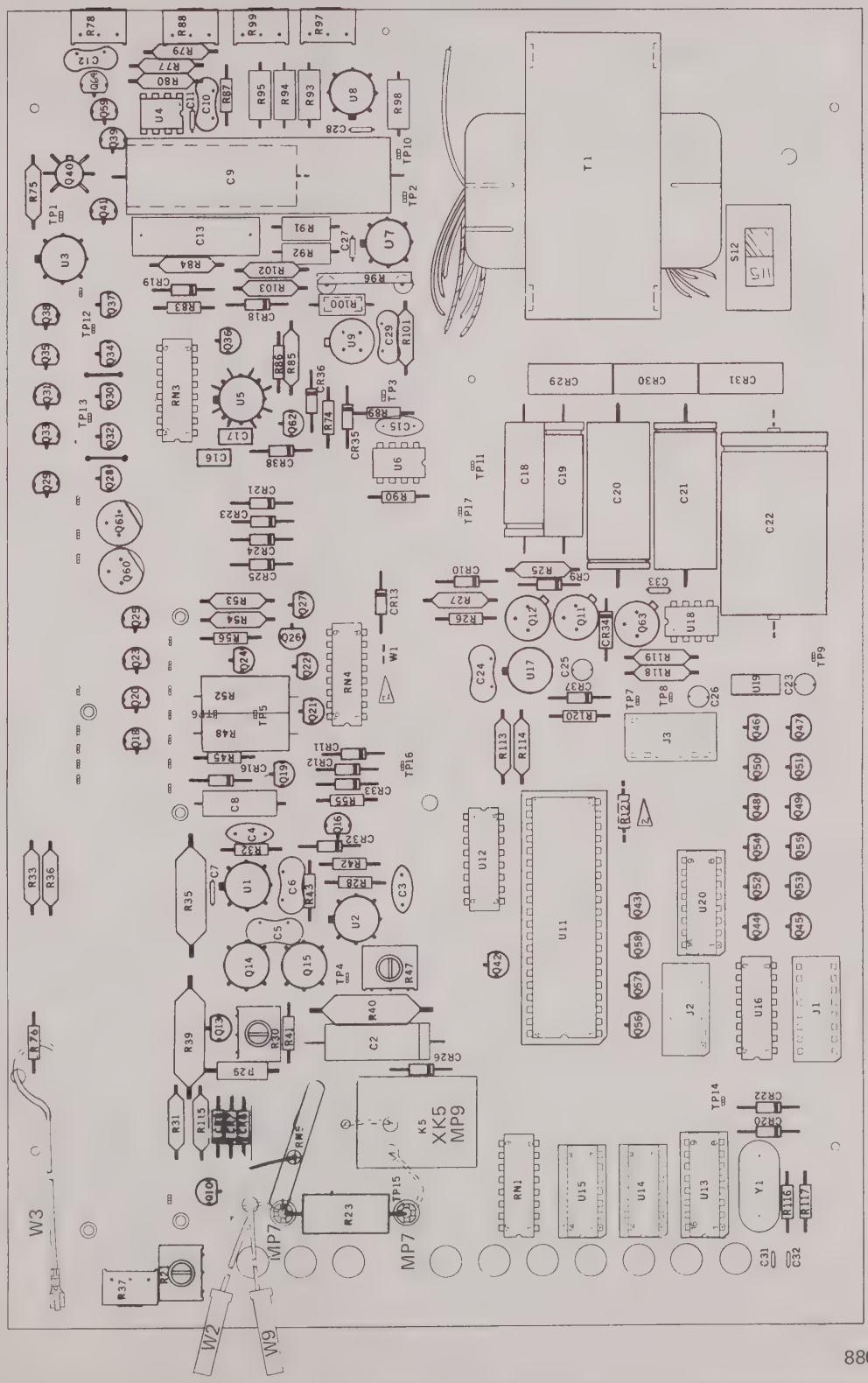


Figure 5-2. A1, MAIN PCB ASSEMBLY

Table 5-3. A2, FRONT PANEL ASSEMBLY

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A2	FRONT PANEL ASSEMBLY FIGURE 5-3 (8800A-4451)	472407	89536	472407	REF		
A2A1	DISPLAY PCB ASSEMBLY	366278	89536	366278	1		
H1	NUT, NYLON, 6-32	111013	89536	111013	4		
H2	WASHER, FIBER	145391	89536	145391	1		
H3	WASHER, FLAT	111310	89536	111310	1		
H4	SCREW, 4-40 X 1/4	178590	89536	178590			
MP1	ACTUATOR, SWITCH, GREEN	420604	89536	420604	1		
MP2	ACTUATOR, SWITCH, GREY	420596	89536	420596	10		
MP3	BINDING POST, BLACK	493973	83330	21527-103	2		
MP4	BINDING POST, BLUE	493999	83330	21527-105	1		
MP5	BINDING POST, RED	493981	83330	21527-102	2		
MP6	CONNECTOR TAB	267609	00779	60837-1	1		
MP7	DECAL 1, FRONT PANEL	376764	89536	376764			
MP8	DECAL 2, FRONT PANEL	376772	89536	376772	1		
MP9	LINK, SHORTING	101220	24655	0938-9712	1		
MP10	NUT, NYLON, 6-32	111013	89536	89536	4		
MP11	PANEL, FRONT, MOLDED	363663	89536	363663	1		
MP12	RETAINING RING	355586	89536	355586	10		
MP13	SLUG, ACTUATOR	393975	89536	393975	11		
MP14	SPACER, NYLON	102665	89536	102665	8		

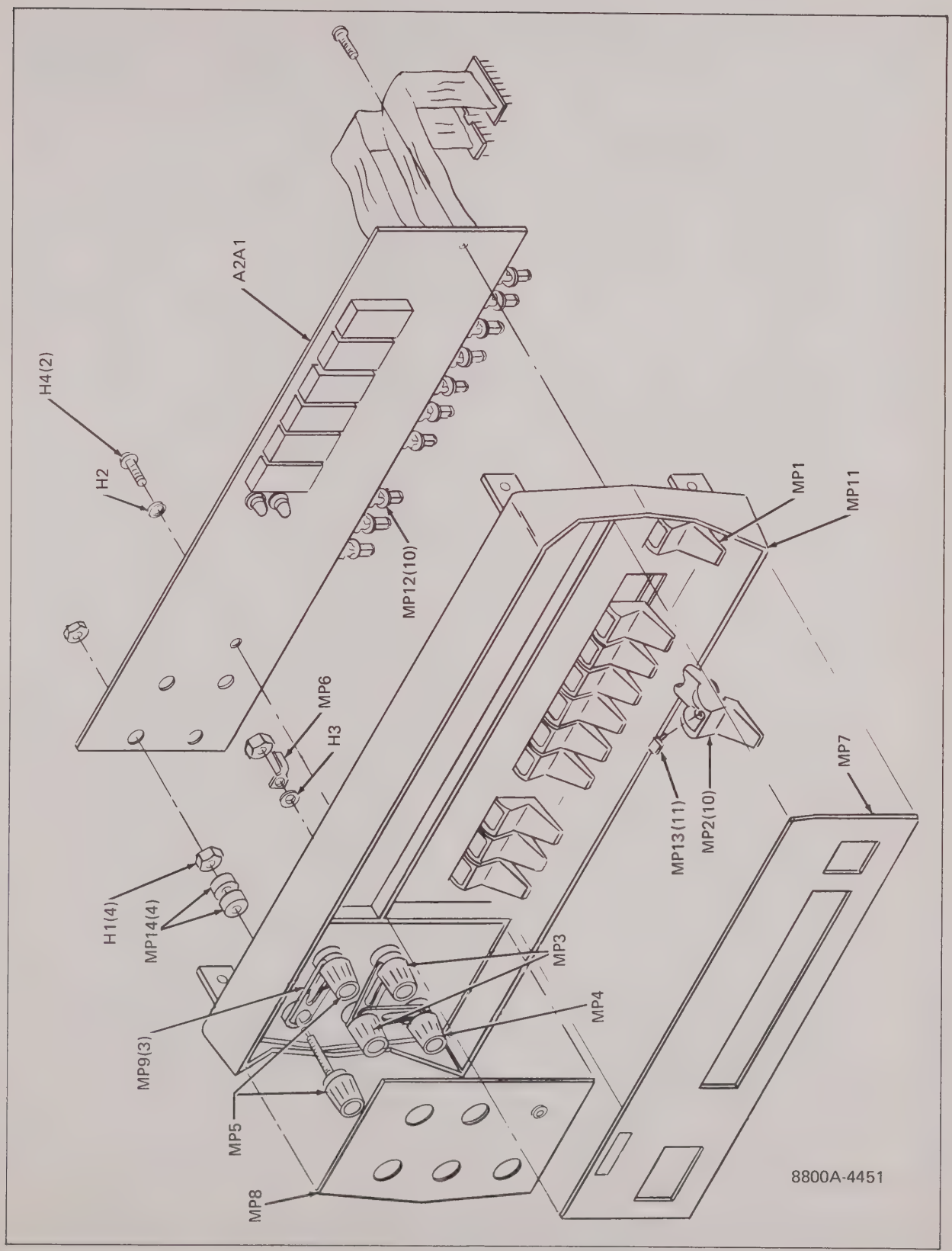


Figure 5-3. A2, FRONT PANEL ASSEMBLY

Table 5-4. A2A1, DISPLAY PCB ASSEMBLY

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A2A1	DISPLAY PCB ASSEMBLY FIGURE 5-4 (8800A-4002T)	366278	89536	366278	REF		
C1	CAP, CER, 47 PF +/-10%, 2K/3.5V	282145	00656	HVD34P10PCT	1		
CR2	DIODE, LED	385914	89536	385914	2	1	
CR3	DIODE, LED	385914	89536	385914	REF		
DS1	DISPLAY, LED	472951	89536	472951	1		
DS2	DISPLAY, LED	429985	89536	429985	5		
DS3	DISPLAY, LED	429985	89536	429985	REF		
DS4	DISPLAY, LED	429985	89536	429985	REF		
DS5	DISPLAY, LED	429985	89536	429985	REF		
DS6	DISPLAY, LED	429985	89536	429985	REF		
MP1	CONN, POST	379438	00779	86144-5	9		
MP2	MININSERT	376418	89536	376418	1		
P1	CABLE ASSY, 16P	380576	89536	380576	1		
P2	CABLE ASSY, 14P	380568	89536	380568	1		
RN1	RES, NETWORK	381376	89536	381376	1	1	
S1 THRU S10	SWITCH ASSY	390500	89536	390500	1		

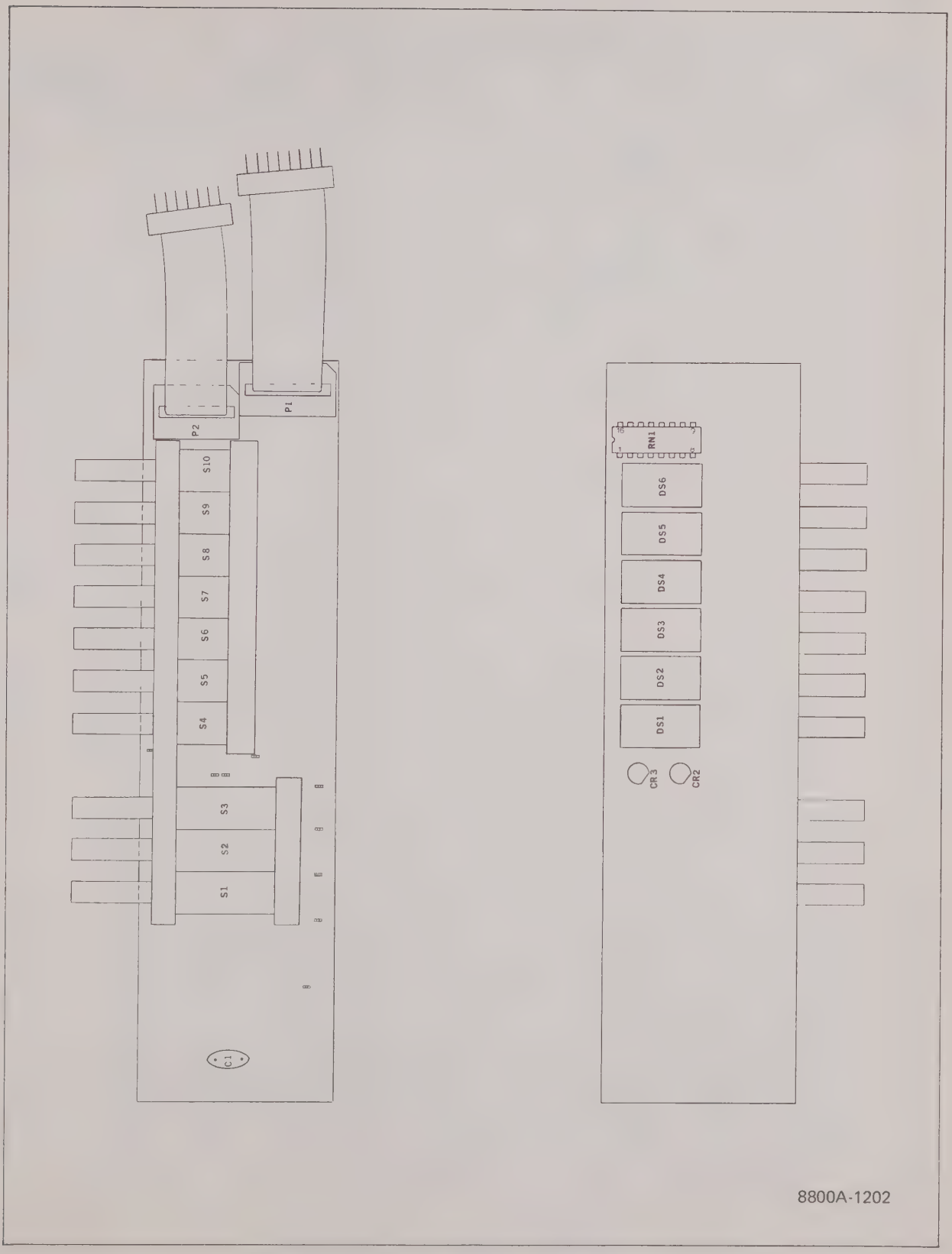


Figure 5-4. A2A1, DISPLAY PCB ASSEMBLY

Table 5-5. A3, OHMS CONVERTER PCB ASSEMBLY

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A3	OHMS CONVERTER PCB ASSEMBLY FIGURE 5-6 (8800A-4010T)	456103	89536	456103	REF		
C1	CAP, POLY, 0.022 UF +/-10%, 100V	333823	01281	863UW22391	1		
C5	CAP, TA, 100 PF +/-10%, 1 KV	105593	71590	DD101	1		
C6	CAP, TA, 10 UF +/- 20%, 15V	193623	56289	196D106X-0015KA1	1		
C8	CAP, MICA, 33 PF +/-5%, 500V	160317	72136	DM15E330J	1		
C9	CAP, MICA, 10 PF +/-5%, 500V	105536	72136	DM15C100J	1		
C10	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	1		
C11	CAP, TA, 4.7 UF +/-20%, 25V	161943	56289	196D475X-0025KA1	1		
C12	CAP, TA, 0.22 UF +/-20%, 35V	161331	56289	196D224X-0035HA1	1		
C13	CAP, CER, 0.05 UF +/-20%, 100V	149161	56289	55C23A1	1		
CR2	LED, RED	385898	12040	59NSL-5046	1	1	
CR4	DIODE, SI, LO-CAP. LO-LEAK	348177	07263	FD7223	5	1	
CR5	DIODE, SI	348177	07263	FD7223	REF		
CR8	DIODE, SI	348177	07263	FD7223	REF		
CR9	DIODE, SI	348177	07263	FD7223	REF		
CR10	DIODE, SI	453399	01295	1N4007	2	1	
CR12	DIODE, SI	453399	01295	1N4007	REF		
CR13	DIODE, SI	348177	07263	FD7223	REF		
K1	RELAY DRY REED, SPST	357582	71707	UF-40070	4		
K2	RELAY, DRY REED, SPST	357582	71707	UF-40070	REF		
K3	RELAY, DRY REED, SPST	357582	71707	UF-40070	REF		
K4	RELAY, DRY REED, SPST	357582	71707	UF-40070	REF		
L1	CHOKE, RF, 4.7 UH	174722	72259	WEE-417	1		
MP1	CONN/PLUG/JACK, RED	170480	74970	105-752	3		
MP2	CONN, RECPT, MOD 2	375329	00779	85863-3	8		
MP3	TERMINAL, FEED-THRU	281865	12615	SL-841-777	4		
MP4	SPACER (NOT SHOWN)	446856	89536	446856	1		
MP5	SPACER (NOT SHOWN)	426882	89536	426882			
R1	RES, DEP CAR, 22K +/-5%, 1/4W	348870	80031	CR251-4-5P22K	2		
R3	RES, DEP CAR, 750 +/-5%, 1/4W	441659	80031	CR251-4-5P750E	1		
R5	RES, VAR, CERMET, 50K +/-10%, 1/2W	288290	89536	288290	1	1	
R6	RES, VAR, CERMET, 2K +/-10%, 1/2W	403428	11236	362S201A	1	1	
R8	RES, VAR, 100 +/-10%, 1/2W	326116	11236	362S101A	1	1	
R10	RES, VAR, 100K +/-10%, 1/2W	288308	89536	288308	1	1	
R11	RES, MF, 1M +/-1%, 1/8W	268797	91637	MFF1-81004F	1		
R12	RES. DEP CAR. 30 +/- 5%, 1/4W	368753	80031	CR251-4-5P30K	5		
R13	RES, VAR, 10K +/-10%, 1/2W	285171	89536	285171	1	1	
R14	RES, MF, 95.3K +/-1%, 1/8W	289561	91637	MFF1-81002F	1		

Table 5-5. A3, OHMS CONVERTER ASSEMBLY (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R16	RES, DEP CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P-1M	3		
R17	RES, DEP CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P-1M	REF		
R18	RES, DEP CAR, 1M +/-5%, 1/4W	348987	80031	CR251-4-5P-1M	REF		
R19	RES, DEP CAR 150K +/-5%, 1/4W	348938	80031	CR251-4-5P-150K	1		
R20	RES, DEP CAR 330K +/-5%, 1/4W	376640	80031	CR251-4-5P-330K	1		
R25	RES, DEP CAR, 120K +/-5%, 1/4W	441386	80031	CR251-4-5P-120K	1		
R26	RES, COMP, 470K +/-5%, 2W	147710	01121	HB4745	1		
R27	RES, DEP CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	1		
R29	RES, DEP CAR, 22K +/-5%, 1/4W	348870	80031	CR251-4-5P22K	REF		
R31	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P-10K	4		
R32	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P-10K	REF		
R33	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P-10K	REF		
R34	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P-10K	REF		
R35	RES, COMP, 390K +/-5%, 1/2W	222190	01121	EB3945	2		
R36	RES, COMP, 390K +/-5%, 1W	453472	01121	GB3945	1		
R37	RES, COMP, 390K +/-5%, 1/2W	222190	01121	EB3945	REF		
R38	RES, DEP CAR, 30K +/-5%, 1/4W	368753	80031	CR251-4-5P-30K	REF		
R39	RES, DEP CAR, 30K +/-5%, 1/4W	368753	80031	CR251-4-5P-30K	REF		
R40	RES, DEP CAR, 30K +/-5%, 1/4W	368753	80031	CR251-4-5P-30K	REF		
R41	RES, DEP CAR, 30K +/-5%, 1/4W	368753	80031	CR251-4-5P-30K	REF		
R42	RES, DEP CAR, 120 +/-5%, 1/4W	442293	80031	CR251-4-5P-120E	1		
R43	RES, DEP CAR, 220 +/-5%, 1/4W	342626	80031	CR251-4-5P-220E	2		
R44	RES, DEP CAR, 220 +/-5%, 1/4W	342626	80031	CR251-4-5P-220E	REF		
RN6	RESISTOR NETWORK	363796	01121	FN274	1	1	
T1	TRANSFORMER, POWER	457168	89536	457168	1		
Q1	XSTR, SI, PNP	225599	12040	PN4250	2	1	
Q2	XSTR, SI, NPN	370684	04713	MPSA42	3	1	
Q3	XSTR, SI, NPN	168716	89536	168716	3	1	
Q4	XSTR, FET, N-CHANNEL	261578	89536	261578	2	1	
Q5	XSTR, SI, NPN	218396	04713	2N3904	4	1	
Q6	XSTR, FET, N-CHANNEL	343830	89536	343830	1	1	
Q7	XSTR, SI, NPN	168716	89536	168716	REF		
Q8	XSTR, FET, N-CHANNEL	261578	89536	261578	REF		
Q9	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q17	XSTR, SI, NPN	168716	89536	168716	REF		
Q21	XSTR, SI, PNP	225599	12040	PN4250	REF		
Q22	XSTR, SI, NPN	370684	04713	MPSA42	REF		
Q23	XSTR, SI, NPN	370684	04713	MPSA42	REF		
Q24	XSTR, SI, NPN	218396	04713	2N3904	REF		

Table 5-5. A3, OHMS CONVERTER ASSEMBLY (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
Q25	XSTR, SI, NPN	218396	04713	2N3904	REF		
W3	WIRE ASSY, SHIELDED	457077	89536	457077	1		
W4	WIRE ASSY, BRN	373738	89536	373738	1		
W5	WIRE ASSY, YEL	457069	89536	457069	1		
W6	WIRE ASSY, BLK/WHT	378281	89536	378281	1		
W7	WIRE ASSY, ORN	457051	89536	457051	1		

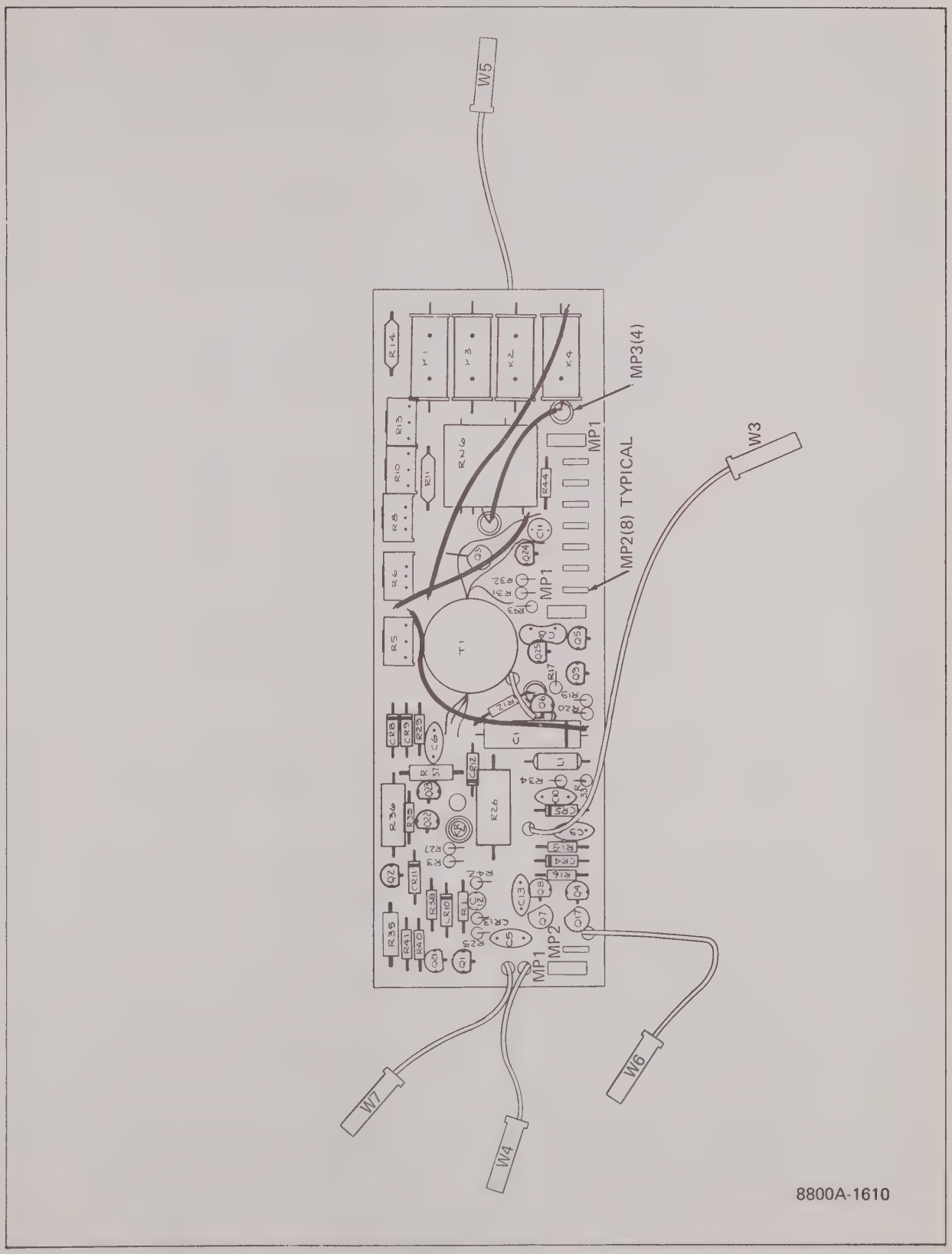


Figure 5-5. A3, OHMS Converter PCB Assembly

Table 5-6. A4, AC CONVERTER PCB ASSEMBLY (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A4	AC CONVERTER PCB ASSEMBLY FIGURE 5-7 (8800A-4014T)	462846	89536	462846	REF		
C1	CAP, CER, 50,000 PF +/-GMV, 1 KV	423004	56289	7S-12595A	1		
C2	CAP,VAR, 0.25-1.5 PF, 100V	273151	72982	530-001	2		
C3	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	2		
C4	CAP, CER, 15 PF +/-2%, 100V	369074	72982	8111-A100-COG-150G	1		
C5	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C6	CAP, CER, 2.2. PF +/-0.25 PF, 100V	362731	72982	8101-A100-COG-229G	1		
C7	CAP, VAR, 0.25-1.5 PF, 100V	273151	72982	530-001	REF		
C8	CAP, CER, 27 PF +/-2%, 100V	362749	72982	8121-A100-COG-270G	1		
C9	CAP, VAR, CER, 1.7-10 PF, 250V	375238	52769	GKC10000	1		
C10	CAP, MICA, 390 PF +/-1%, 500V	355339	72136	DM15D391F	1		
C11	CAP, POLY, 9100 PF +/-2.5%, 160V	355321	71590	2DRP00J-912GAA	1		
C12	CAP, TA, 10 UF +/-20%, 15V	193623	56289	196D106X-0015KA1	1		
C13	CAP, TA, 220 UF +/-20%, 6V	408682	56289	196D227X-0006TE4	3		
C14	CAP, TA, 220 UF +/-20%, 6V	408682	56289	196D227X-0006TE4	REF		
C15	CAP, TA, 5.6 UF +/-20%, 25V	368969	56289	196D565X-0025KA1	1		
C16	CAP, FILM, 0.47 UF +/-10%, 100	369124	73445	C280MAH/A470K	2		
C17	CAP, FILM, 0.47 UF +/-10%, 100	369124	73445	C280MAH/A470K	REF		
C18	CAP, TA, 39 UF +/-20%, 6V	163915	56289	196D396X-0006V	1		
C20	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C023B101F-103M	3		
C21	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C023B101F-103M	REF		
C22	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C023B101F-103M	REF		
C23	CAP, VAR, CER, 5-50 PF, 250V	404301	52769	GKC50000	1		
C26	CAP, TA, 220 UF +/-20%, 6V	408682	56289	196D227X-0006TE4	REF		
CR1	DIODE, SI	375907	07263	FD7222	5	1	
CR2	DIODE, SI	375907	07263	FD7222	REF		
CR3	DIODE, SI	375907	07263	FD7222	REF		
CR4	DIODE, SI	375907	07263	FD7222	REF		
CR5	DIODE, SI	375907	07263	FD7222	REF		
CR6	DIODE, FET, CURRENT REG	334714	07910	TCR5315	1	1	
H1	SCREW, 4-40 X 1/4	129890	89536	129890	3		
K6	RELAY, REED, SPST	357566	71707	UF40069	3		
K7	RELAY, REED, SPST	357566	71707	UF40069	REF		
K8	RELAY, REED, SPST	357566	71707	UF40069	REF		
MP1	CONN, PLUG/JACK, RED	170480	74970	105-752	2		
MP2	CONN, RECEPTACLE, BD-MOD2	375329	00779	85863-3	8		
MP3	HEATSINK, (USED WITH U1)	370155	05820	204-CB	1		
MP4	SHIELD	406280	89536	406280	1		

Table 5-6. A4, AC CONVERTER PCB ASSEMBLY (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
MP5	SPACER, XSTR MTG	175125	07047	10172-DAP	1		
MP6	SPACER, PCB, (USE WITH R1)	334797	32559	TO-35-15	1		
MP7	SPACER, PCB, (USE WITH C2, C7)	380790	32559	TO-21-10	2		
Q1	XSTR, DUAL FET	379321	89536	379321	1	1	
Q2	XSTR, SI, NPN	218396	04713	2N3904	2	1	
Q4	XSTR, SI, PNP, SELECTED	352146	89536	352146	1	1	
Q5	XSTR, SI, NPN	330803	04713	MPS6560	1	1	
Q6	XSTR, FET, N-CHANNEL	343830	89536	343830	3	1	
Q7	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
Q8	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q9	XSTR, FET, N-CHANNEL	343830	89536	343830	REF		
R1	RES, MF, 2M +/-0.5%, 1W (RED COATING)	354894	89536	354894	1		
R2	RES, MF, 71.5K +/-1%, 1/8W	291435	91637	MFF1-87152F	1		
R3	RES, MF, 158K +/-1%, 1/8W	237214	91637	MFF1-81583F	1		
R4	RES, DEP CAR, 240 +/-5%, 1/4W	376624	80031	CR251-4-5P-240E	1		
R5	RES, MF, 498.89K +/-0.1%,1/4W	357632	89532	357632	1		
R6	RES, VAR, CERMET, 2K +/-10%, 1/2W	285163	89536	285163	1	1	
R7	RES, MF, 55,151 +/-0.1%, 1/8W	357624	89536	357624	1		
R8	RES, VAR, CERMET, 200 +/-10%, 1/2W	285148	89536	285148	1	1	
R9	RES, MF, 4787.4 +/-0.1%, 1/8W	357616	89536	357616	1		
R10	RES, VAR, CERMET, 20 +/-20%, 1/2W	285114	11236	360TS200B	1	1	
R11	RES, MF, 250 +/-0.1%, 1/8W	357608	91637	MFF1-82510B	2		
R12	RES, DEP CAR, 1 +/-5%, 1/4W	357665	80031	CR251-4-5P-1E	1		
R13	RES, MF, 9.09K +/-1%, 1/8W	221663	91637	MFF1-89091F	1		
R14	RES, MF, 33.2K +/-1%, 1/8W	291393	91637	MFF1-83322F	1		
R17	RES, MF, 250 +/-0.1%, 1/8W	357608	91637	MFF1-82510B	REF		
R18	RES, DEP CAR, 3.3K +/-5%, 1/4W	348813	80031	CR251-4-5P-3K3	1		
R19	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P-10K	1		
R20	RES, VAR, CERMET, 50 +/-10%, 1/2W	285122	89536	285122	1	1	
R21	RES, MF, 2194 +/-0.1%, 1/8W	375345	89536	375345	1		
R22	RES, MF, 68.1K +/-1%, 1/8W	236828	91637	MFF1-86812F	1		
R23	RES, DEP CAR, 150K +/-5%, 1/4W	348938	80031	CR251-4-5P-100K	1		
R24	RES, DEP CAR, 220K +/-5%, 1/4W	348953	80031	CR251-4-5P-220K	1		
R25	RES, DEP CAR, 47K +/-5%, 1/4W	348896	80031	CR251-4-5P-47K	1		
R26	RES, DEP CAR, 22 +/-5%, 1/4W	381145	80031	CR251-4-5P-22E	1		
R27	RES, DEP CAR, 75K +/-5%, 1/4W	394130	80031	CR251-4-5P-75K	1		
R28	RES, DEP CAR, 12K +/-5%, 1/4W	348847	80031	CR251-4-5P-12K	1		
R29	RES, COMP, 100K +/-5%, 1/4W	148189	01121	CB1045	1		
R30	RES, VAR, CERMET, 1K +/-10%, 1/2W	275750	89536	275750	1	1	
R31	RES, MF, 48.7K +/-1%, 1/8W	267385	91637	MFF1-84872F	1		
U1	IC, OP AMP	329912	12040	LM318H	1	1	
W8	WIRE ASSEMBLY	373688	89536	373688	1		

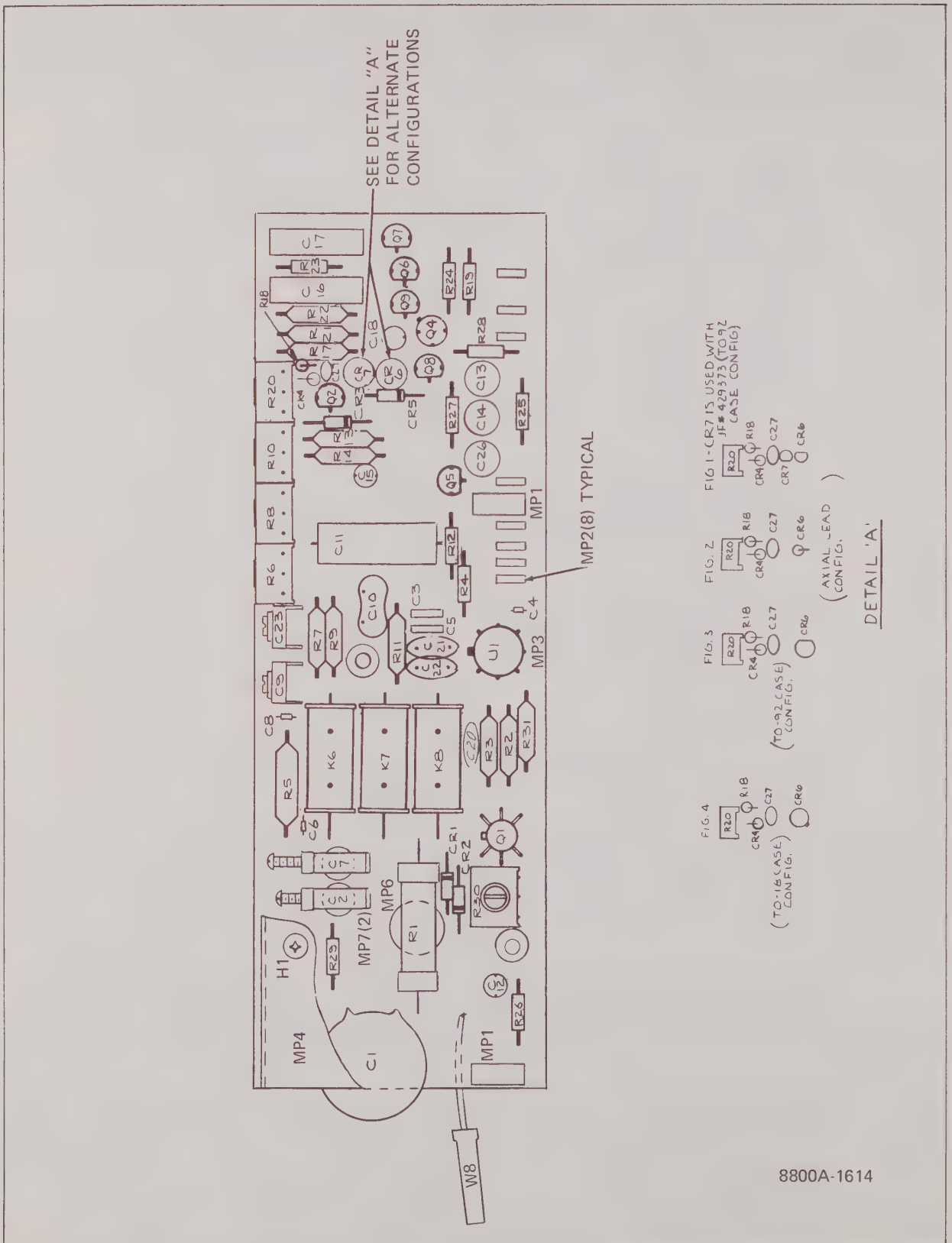


Figure 5-6. A4, AC CONVERTER PCB ASSEMBLY

Section 6
Option & Accessory Information

TABLE OF CONTENTS

OPTION/ MODEL NO.	DESCRIPTION	PAGE
	ACCESSORIES	
M00-200-625	Rack Mount Kit	600-1
A90	Current Shunt	600-2
Y8100	DC/AC Current Probe	600-2
Y8133	Test Lead Set	600-2
Y8140	Test Lead Set	600-3
Y9108	BNC Jack -to-Banana Plug Adapter	600-3
80F-15	High Voltage Probe	600-3
80K-40	High Voltage Probe	600-5
80J-10	Current Shunt	600-6
80T-150	Temperature Probe	600-6
81RF	High Frequency Probe	600-7
82RF	High Frequency Probe	600-8
	OPTIONS	
-002	Data Output Unit	002-1

6-1. INTRODUCTION

6-2. This section of the manual documents the accessories and options available for use with the 8800A. It consists of a table of contents and an introduction followed by a series of subsections. The first subsection provides a description and the specifications for each of the applicable accessories. The second subsection documents the Data Output Unit, Option-002.

6-3. Unique page and paragraph numbers are used to identify each of the subsections. For example, the 600-x series identifies the accessories subsection, and the 002-x series identifies the subsection for the -002 Option (x is the sequential page or paragraph number).

Accessories

600-1. INTRODUCTION

600-2. This subsection describes the accessories available for use with the 8800A Digital Multimeter. Each accessory is described separately. The descriptions are intended to acquaint the prospective user with the features and capabilities of the accessories. Detailed information is supplied with each accessory.

600-3. RACK MOUNT KIT

600-4. The Model M00-200-625 Rack Mount Kit is a rack-panel adapter that allows the 8800A to be mounted in a standard 19-inch equipment rack. Panel height of the adapter is 3½ inches. Figure 600-1 shows the physical components included in the kit and the mounting details for installing the 8800A. Detailed installation instructions are supplied with the kit.

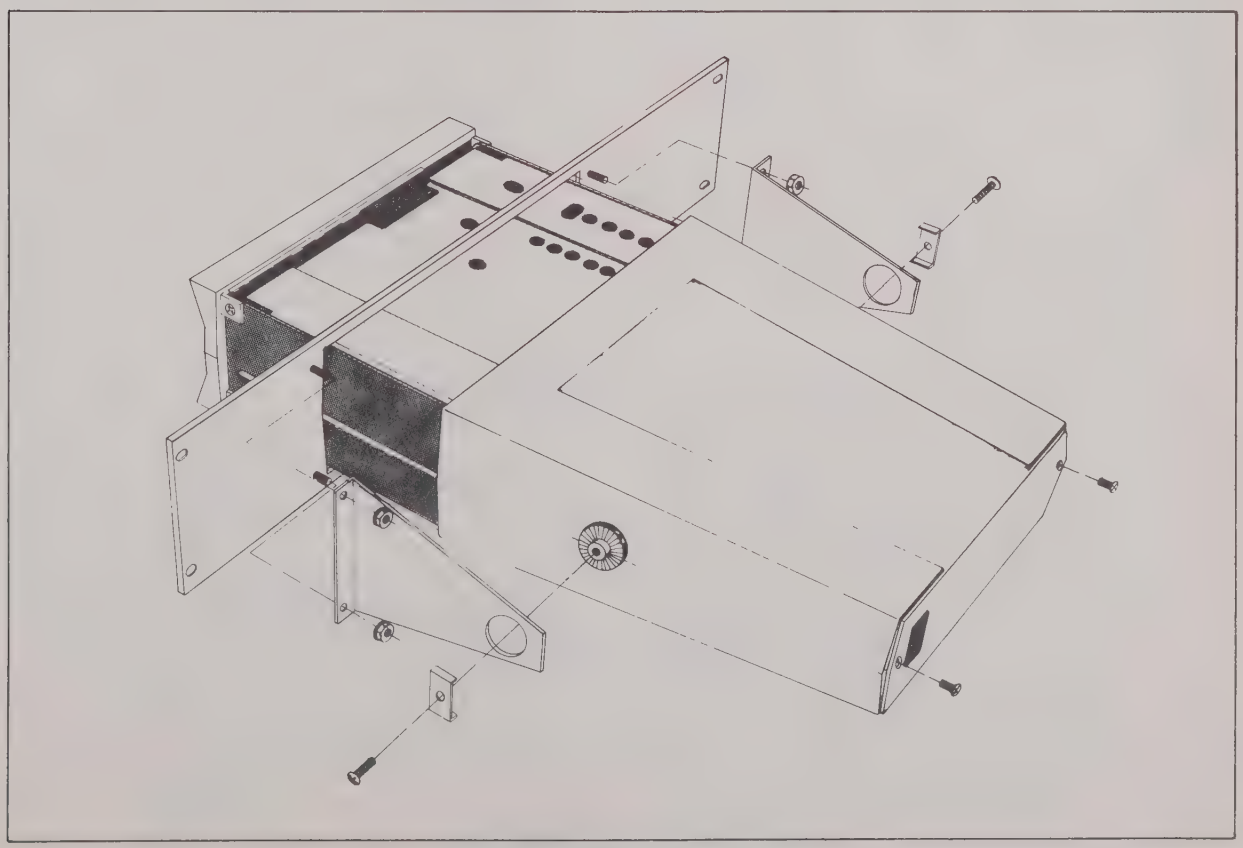


Figure 600-1. Rack Mount Kit

600-5. A90 CURRENT SHUNT

600-6. Description

600-7. The Model A90 Current Shunt may be used in conjunction with the 8800A for making both ac and dc current measurements over a wide current range. Physical characteristics of the unit are shown in Figure 600-2.

600-8. Specifications

600-9. The specifications for the A90 are given in Table 600-1. Accuracy specifications assume that the DMM input impedance is >10 megohms and are stated as ±(% of input ±% of range).

600-10. Y8100 DC/AC CURRENT PROBE

600-11. Description

600-12. The Model Y8100, as shown in Figure 600-3, is a battery-powered clamp-on current probe for measuring currents up to 200A dc or ac rms. Two ranges are provided on the probe, 20A and 200A. The probe produces a dc output voltage proportional to the measured current. At full scale the output of the probe is 2V dc. Current carrying conductors up to 1.9 cm (0.75 inches) in diameter can be placed within the probe clamp.

600-13. Specifications

Full Range Output. . .	2V dc
Accuracy (output)	
DC to 200 Hz . . .	±2% of Range
200Hz to 1 kHz . .	<100A add ±3% of reading >100A add ±6% of reading
Frequency Response. .	dc to 1.0 kHz
Recommended Load. .	>3 kilohms
Temperature Range	
Operating	+5°C to +35°C
Storage and operation at reduced accuracy .	−10°C to +50°C
Heating Limitation . .	Prolonged operation above 200A ac or 1 kHz can damage the probe.
Working Voltage Rating	Core to output: 600V dc or 480V ac maximum. Output to ground: 42V dc or 30V ac maximum.

600-14. Y8133 TEST LEAD SET

600-15. The Model Y8133 Test Lead Set includes two leads, a series of detachable probes and tips, and a storage pouch. As shown in Figure 600-4A, three probes are provided, two with pointed tips and a third with a spring loaded hook- tip. The detachable tips include two alligator clips and two spade lugs.

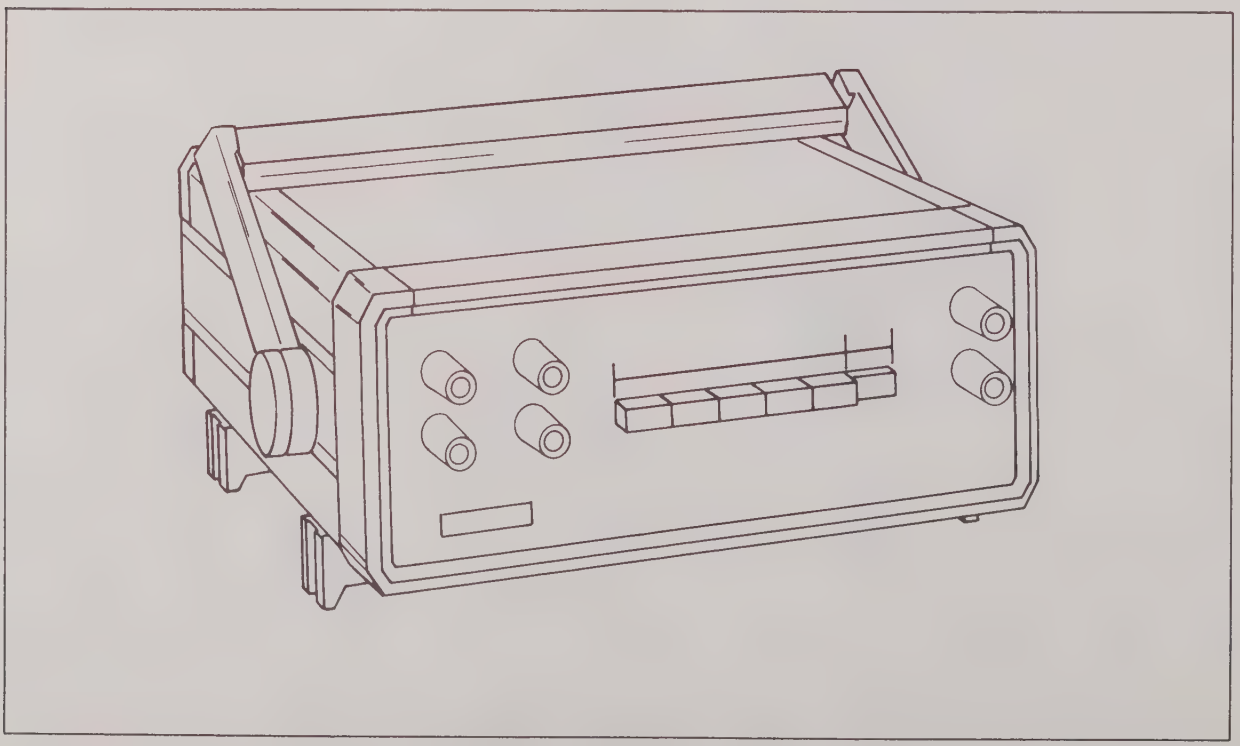


Figure 600-2. A90 Current Shunt

Table 600-1. A90 Specifications

RATED CURRENT RANGE	VOLTAGE BURDEN (APPROX)	SHUNT VALUE	OUTPUT AT RATED CURRENT	ACCURACY	
				DC	30 Hz-10 kHz
0.1 mA	100 mV	1 kΩ	100 mV	±(0.15 + 0.1)	±(0.3 + 0.5)
1.0 mA	100 mV	100Ω	100 mV	±(0.15 + 0.1)	±(0.3 + 0.5)
10 mA	100 mV	10Ω	100 mV	±(0.15 + 0.1)	±(0.3 + 0.5)
100 mA	102 mA	1Ω	100 mV	±(0.15 + 0.1)	±(0.3 + 0.5)
1A	120 mV	0.1Ω	100 mV	±(0.15 + 0.1)	±(0.4 + 0.5)
10A	300 mV	0.01Ω	100 mV	±(0.25 + 0.1)	±(0.5 + 0.5)*

**30 Hz to 4 kHz on 10A range*

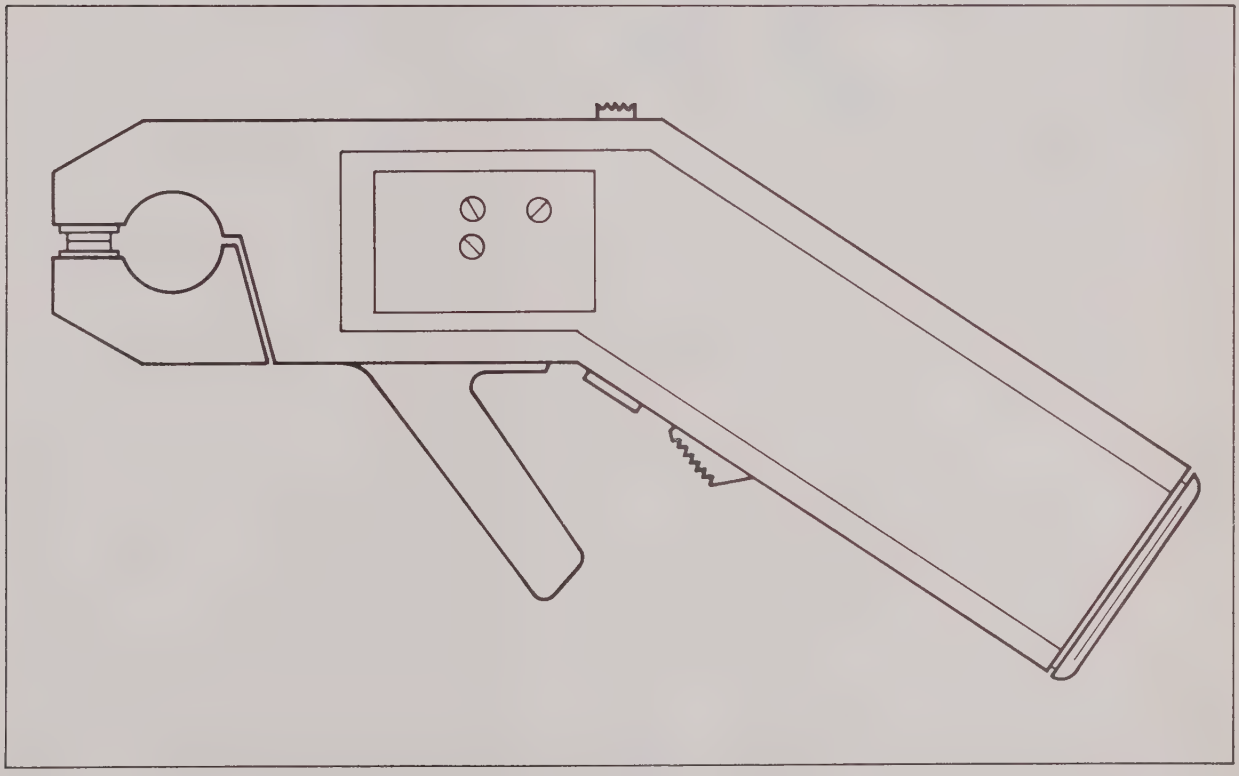


Figure 600-3. Y8100 DC/AC Current Probe

600-16. Y8140 TEST LEAD SET

600-17. The Model Y8140 Test Lead Set consists of two test leads with a retractable needle-point tip on each probe. Both tips are insulated up to their point and are flexible in the extended position. Details of the probe set are shown in Figure 600-4B.

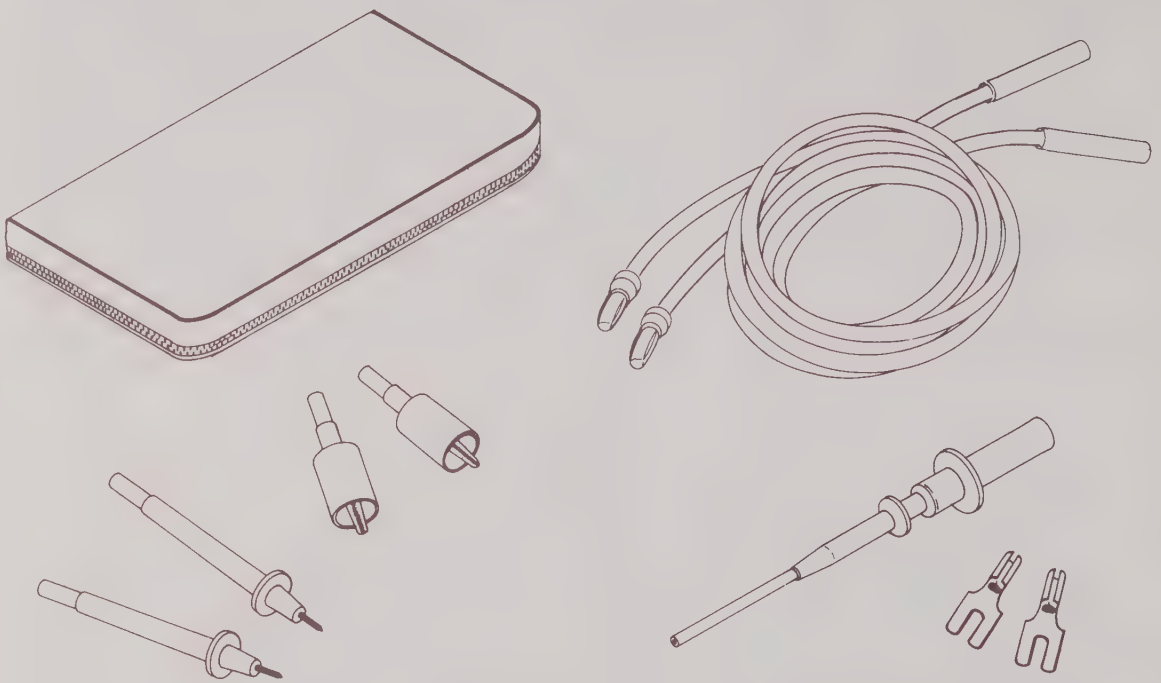
600-18. Y9108 BNC JACK-TO-BANANA PLUG ADAPTER

600-19. The Model Y9108 is a BNC-to-banana plug adapter for making BNC connections to the DMM input terminals. Both the banana plugs and the BNC connection are male.

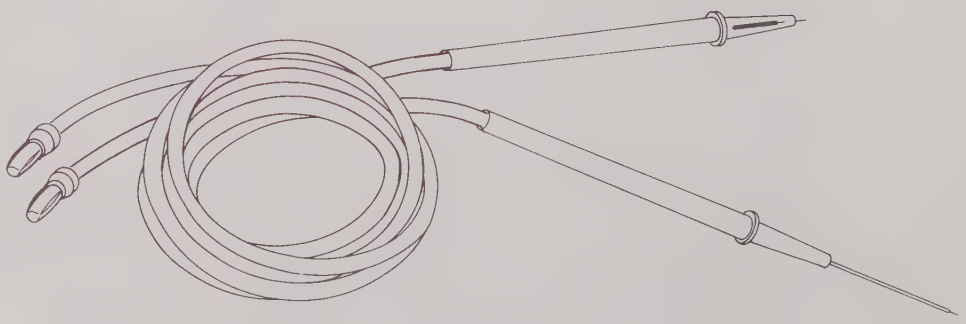
600-20. 80F-15 HIGH VOLTAGE PROBE

600-21. Description

600-22. The Model 80F-15 is a high voltage probe that extends the dc voltage measurement capability of the DMM up to 15 kV. Special metal film resistors with matched temperature coefficients divide the input voltage by 1000. As a result, a 15 kV input to the probe appears as a 15 volt input to the DMM. The probe is shown in Figure 600-5.



A. Y8133 TEST LEAD SET



B. Y8140 TEST LEAD SET

Figure 600-4. Test Leads Sets

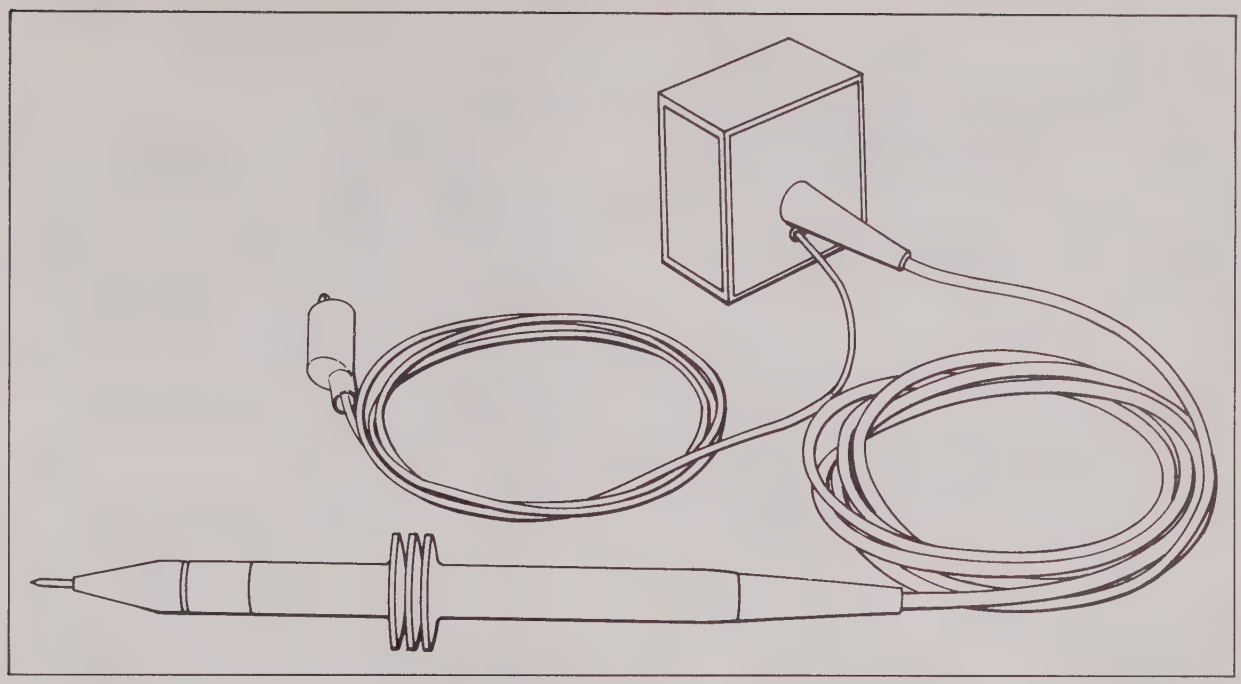


Figure 600-5. 80F-15 High Voltage Probe

600-23. Specifications

Voltage Range	1 kV to 15 kV dc maximum
Input Resistance . . .	100 megohms
Division Ratio	1000:1
Accuracy	
(1 year, 23°C)	±0.05% of input into a 10 megohm ±0.01% DMM
Stability of Ratio	
1 Month	±0.01%
1 Year	±0.05%
Voltage Coefficient . .	<±0.002% total from 0 to 15,000V dc
Temperature Range . .	0°C to +50°C
Temperature Coefficient	0.001% per °C
Relative Humidity . .	0 to 80%
Operating Altitude . .	0 to 10,000 feet
Cable Length	1.5m (5 feet)
Weight	680g (24 ounces)

600-24. 80K-40 HIGH VOLTAGE PROBE

600-25. Description

600-26. The Model 80K-40, as shown in Figure 600-6, is a high voltage probe designed to extend the ac and dc voltage measuring capability of the DMM up to 40 kV. In essence, the probe is a 1000:1 divider formed by two matched metal-film resistors. The unusually high input impedance offered by these resistors minimizes circuit loading and optimizes measurement accuracy. A special plastic body houses the divider and provides the user with isolation and protection from the voltage being measured.

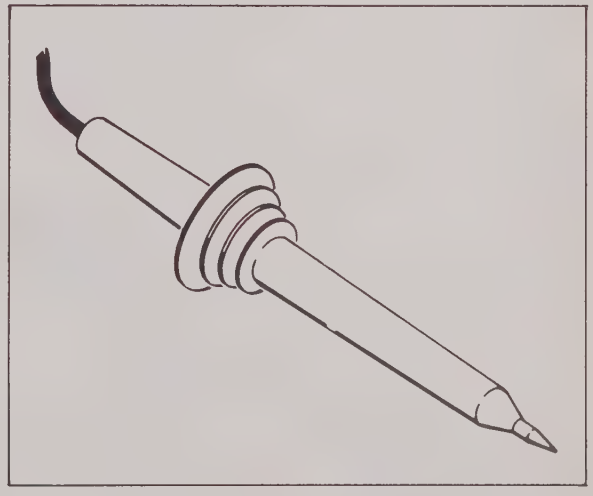


Figure 600-6. 80K-40 High Voltage Probe

600-27. Specifications

600-28. The following specifications assume that the probe is used with a voltmeter having a 10 megohm input impedance. A correction factor or a shunt resistor must be used if the input impedance of the voltmeter is other than 10 megohms.

Voltage Range	1 kV to 40 kV dc or peak ac, 28 kV rms ac
Input Resistance . . .	1000 megohms
Division Ratio	1000:1

Accuracy
DC
1 kV to 20 kV . . Linear change from ±4% to ±2%
20 kV to 30 kV . ±2% (calibrated to 1% at 25 kV)
30 kV to 40 kV . Linear change from ±2% to ±4%
AC . . . . . ±5% at 60 Hz

600-29. 80J-10 CURRENT SHUNT

600-30. Description

600-31. The Model 80J-10 is a plug-in shunt designed to convert a voltmeter into a current meter. Two banana plugs, see Figure 600-7, with 0.75-inch spacing are used to connect the shunt to the input terminals of the voltmeter. Input connections to the shunt are made at two 5-way binding posts. The shunt value is selected to provide a 10 mV per ampere output.

600-32. Specifications

Sensitivity . . . . . 10 mV per ampere
Shunt Resistance . . . 0.01 ohms
Accuracy . . . . . ±0.25% from dc to 10 kHz, rising 1 dB at 100 kHz
Series Inductance. . . 8.3 nh
Overload . . . . . >20A, not fused

600-33. 80T-150 TEMPERATURE PROBE

600-34. Description

600-35. The Model 80T-150, as shown in Figure 600-8, is a universal temperature probe designed to provide a DMM with temperature measuring capability. Temperature is sensed at the probe tip and converted into a voltage for use by the DMM. The conversion factor is 1 mV per degree. Temperature scales in degrees Celsius or Fahrenheit may be specified at the time of purchase or selected by the user. Operating power for the probe is supplied by disposable batteries. Battery life is 1000 hours of continuous use. An on/off switch is provided to conserve battery life when the unit is not in use.

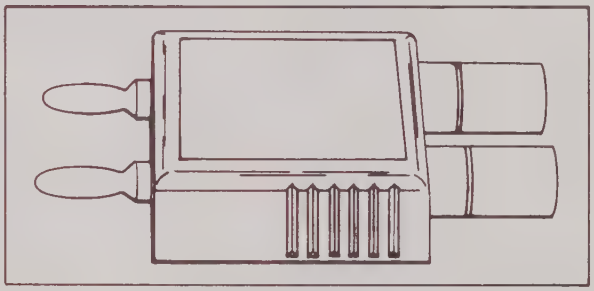


Figure 600-7. 80J-10 Current Shunt

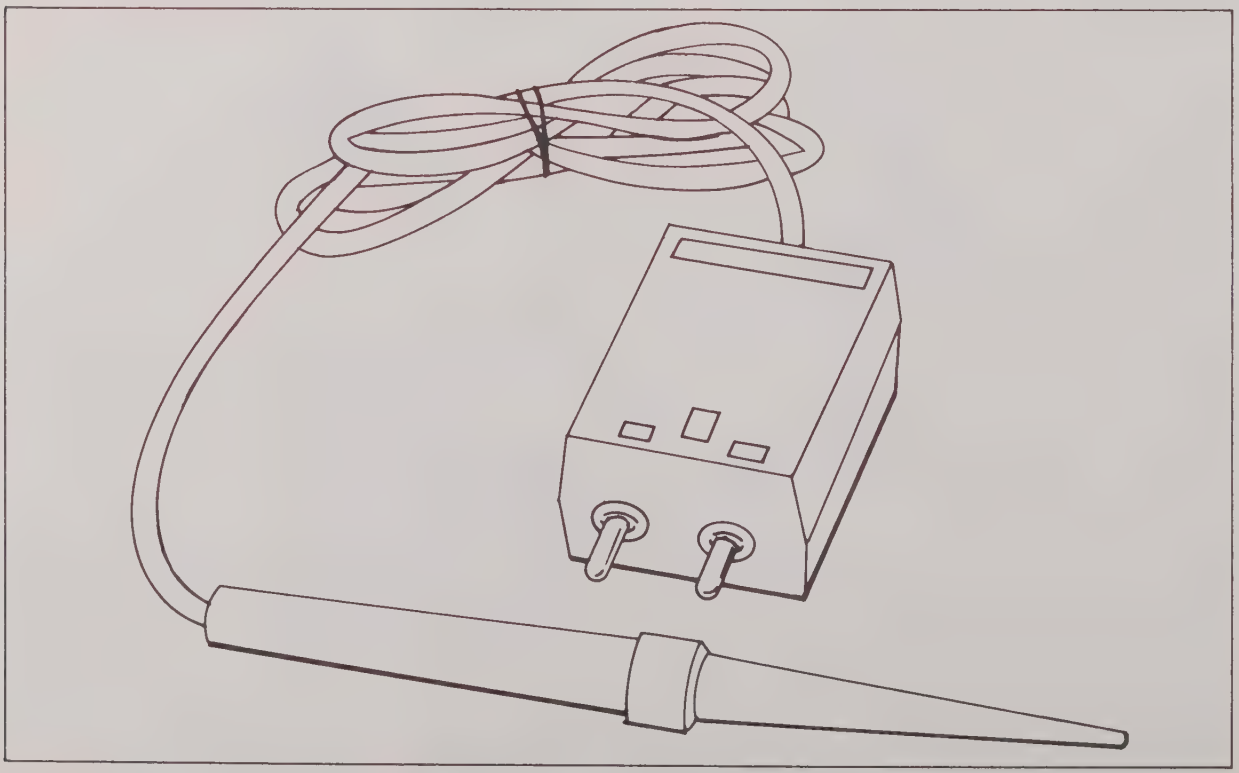


Figure 600-8. 80T-150 Temperature Probe

600-36. Specifications

Range	−50°C to +150°C, −58°F to +302°F
Range Selection	Internal Jumpers
Sensitivity	1 mV per °C or °F
Resolution	0.1°C or 0.1°F recommended maximum
Ambient Temperature	
Range	0°C to +50°C
Relative Humidity	<80% non condensing
Accuracy	Including nominal ±0.25% voltmeter error at +15°C to +35°C ambient. Add 1°C to the accuracy specifications if ambient temperature is below +15°C or above +35°C
−50°C to −25°C	±3°C
−25°C to +125°C	±2°C
+125°C to +150°C	±3°C
Voltmeter Input Impedance	>10 megohm
Maximum Voltage	Probe tip to circuit low, 350V dc or peak ac
Settling Time	8 seconds to settle to within 1 degree after a 100 degree step change at the probe tip
Power	Internal disposable battery, 1000 hours of continuous use
Controls	Power on/off switch

600-37. 81RF HIGH FREQUENCY PROBE

600-38. Description

600-39. The Model 81RF is designed to convert a dc voltmeter with a 10 megohm input impedance into a high frequency ac voltmeter. It provides a useful frequency range of 20 kHz to 250 MHz. Physical characteristics of the probe are shown in Figure 600-9. The output of the probe is a dc voltage calibrated to equal the rms value of a 1MHz sine wave input.

600-40. Specifications

Frequency Response	±1 dB from 100 kHz to 100 MHz (Relative to ac/dc transfer ratio)
AC-to-DC Transfer Ratio (23 +5°C)	
RMS Input (100 kHz)	DC Output
0.25 to 0.5V	0.25 to 0.5V ±1.5 dB
0.5 to 2.0V	0.5 to 2.0V ±0.5 dB
2.0 to 30V	2.0 to 30V ±1.0 dB
Extended Frequency Response	Useful for relative readings from 20 kHz to 250 MHz
Response	Responds to peak value of input; Calibrated to read rms value of a sine wave
Voltage Range	0.25 to 30V rms
Maximum DC Input	350V dc
Temperature Coefficient (0 to 18°C, 28 to 50°C)	<0.1 of ac-to-dc transfer ratio specification per °C
Input Impedance	12 megohms shunted by 15 pF

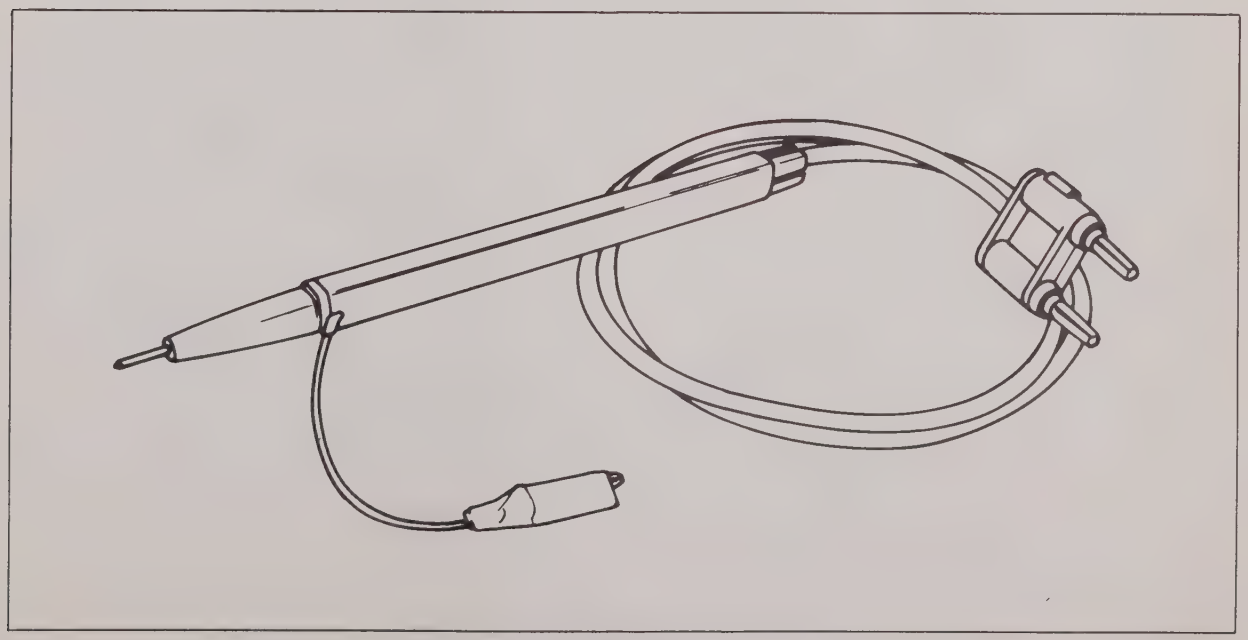


Figure 600-9. 81RF High Frequency Probe

600-41. 82RF HIGH FREQUENCY PROBE

600-42. Description

600-42. The Model 82RF is designed to convert a dc voltmeter with a 10 megohm input impedance into a high frequency voltmeter. It provides a useful frequency range of 20 kHz to 700 MHz. Physical characteristics of the probe are shown in Figure 600-10 (a BNC probe tip adapter is supplied with the 82RF). The output of the probe is a dc voltage calibrated to equal the rms value of a sine wave input.

600-44. Specifications

600-45. The frequency response and the ac-to-dc transfer ratio specifications assume the use of the BNC adapter supplied with the probe and a voltmeter with a 10 megohm input impedance shunted by less than 200 pF.

Frequency Response	Relative to ac-to-dc transfer ratio
100 kHz to 200 MHz	±1 dB
200 MHz to 500 MHz	±3 dB

AC-to-DC Transfer Ratio (23 +5°C)

RMS Input (10 MHz)	DC Output
0.25 to 0.5V	0.25 to 0.5V ±1.5 dB
0.5 to 2.0V	0.5 to 2.0V ±0.5 dB
2.0 to 5.0V	2.0 to 5.0V ±1.0 dB
5.0 to 30V	5.0 to 30V ±1.5 dB

Extended Frequency Response	Useful for relative readings from 20 kHz to 700 MHz
Response	Responds to peak value of input; Calibrated to read the rms value of a sine wave
Voltage Range	0.25 to 30V rms
Maximum Input Voltage	30V rms, 200V dc
Input impedance	2 megohms shunted by <10 pF
Temperature Coefficient	<0.1 of ac-to-dc transfer ratio specification per °C
Output Connector	Fits standard 0.75-inch spaced dual banana connectors
BNC Adapter	Slip-on BNC adapter is supplied with the probe

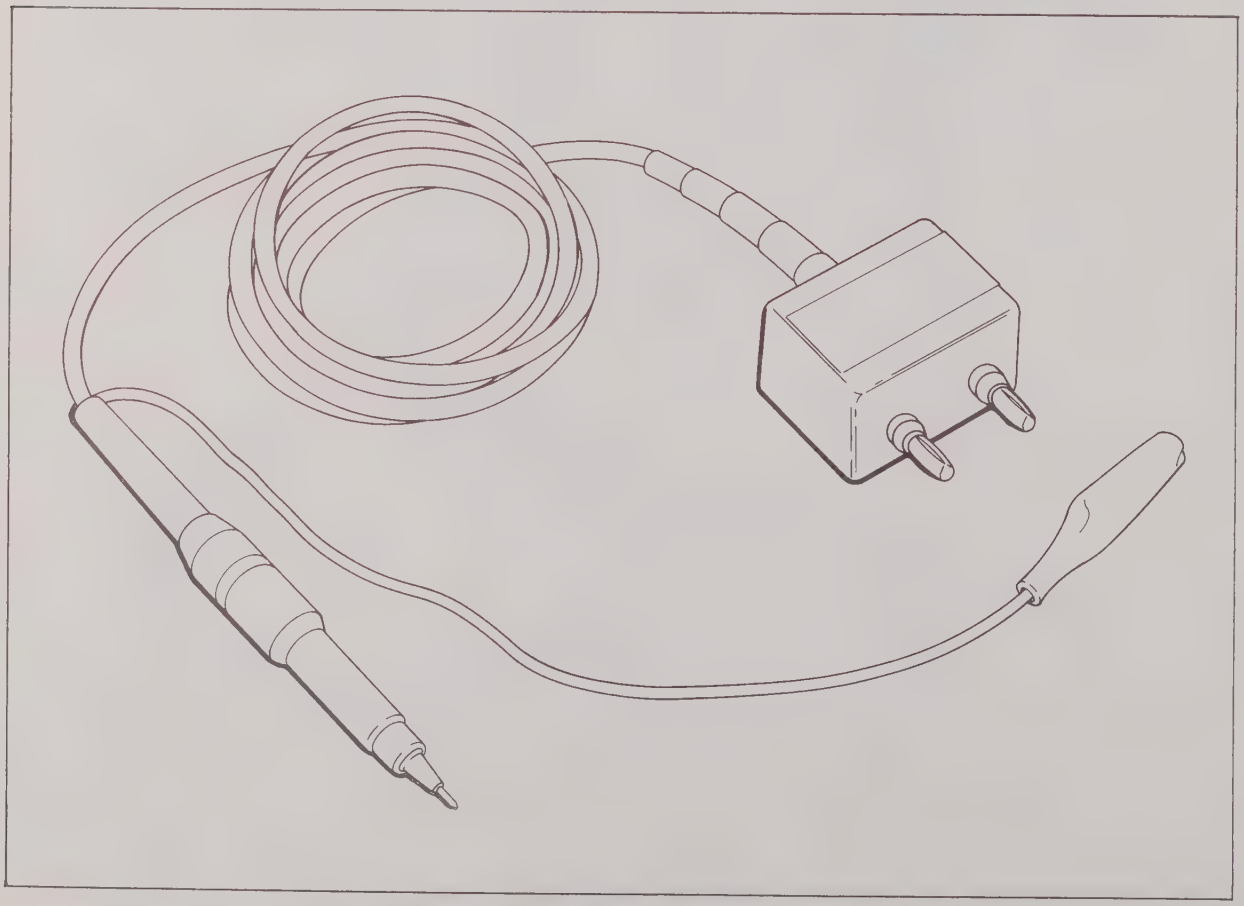


Figure 600-10. 82RF High Frequency Probe

600-46. GENERAL PURPOSE ACCESSORIES

600-47. Several other general purpose accessories, such as adapters, connectors, and attenuators, are available from Fluke. These are listed and described in Table 600-2.

Table 600-2. General Purpose Accessories

MODEL NO.	DESCRIPTION		
Y9100	6 dB Attenuator (2X), 50 ohm, 2 watt, BNC	Y9110	BNC Jack to PCB Pins
Y9101	14 dB Attenuator (5X), 50 ohm, 2 watt, BNC	Y9111	3-Foot BNC Cable (97 cm)
Y9102	20 dB Attenuator (10X), 50 ohm, 2 watt, BNC	Y9112	6-Foot BNC Cable (1.95m)
Y9103	50 ohm BNC Feed-through Termination	Y9113	BNC Plug to Dual Banana Plug
Y9104	Alligator Clip to fit pin tip	Y9114	BNC Jack to 1/4" Phone Plug
Y9105	Alligator Clip to fit banana plug	Y9115	1/4" Phone Jack to BNC Plug
Y9106	BNC Tee (3 Jacks)	Y9116	BNC Jack to Phono Plug
Y9107	BNC Tee (Jack-Plug-Jack)	Y9117	Phono Jack to BNC Plug
Y9108	BNC Jack to Dual Banana Plug	Y9118	1/4" Phone Jack to Dual Banana Plug
Y9109	Binding Posts to BNC Plug	Y9119	Phono Jack to Dual Banana Plug

Option -02
Data Output Unit

002-1. INTRODUCTION

002-1. The Data Output Unit (DOU) provides digital measurement information to a rear panel output connector for use by remote desplay instruments or data printers. The output data is in parallel bed format and is compatible with the Fluke Model 2010A Digital Printer.

002-3. SPECIFICATIONS

002-4. The specifications for the DOU are presented in Section 1 of this manual.

002-5. OPERATION

002-6. DOU Data Identification

002-7. The data available at the rear panel DOU connector is listed in Table 002-1. The connector pin assignment and logic level requirements for each signal are provided.

002-8. Data Update

002-9. Refer to DOU Schematic, Section 8 and the timing diagram (Figure 002-1) for the following discussion. The DOU output can be updated by an external command (ARM ENABLE, ARM INPUT) or allowed to update automatically (FREE RUN) at the end of each new instrument measurement. A logic level 1 (+4.75 to +5.25V) applied to ARM ENABLE (pin B) and a logic level 0 applied to FREE RUN will prevent acquisition of new data by the DOU. A positive going trigger applied to ARM INPUT (pin C) will enable the DOU to acquire data. New data will start to load into the DOU after the next measurement is complete. BZ (from the instrument to the DOU) occurs synchronously with the second STO signal after a measurement is complete and lasts for one strobe cycle. BZ is presented to U10 as a data input. ST5 clocks the data into U10. As soon as data appears in U10, RG is applied through U11 and the isolation circuit to U4, U3, U2, and U1. At this time the busy flags are applied to the DOU output signifying that data is being changed. U10 enables the data on W to be serially loaded into the bottom of U4 during the first strobe cycle. When ST5 occurs again, the data in U10 is shifted to enable the data on X to be loaded into U4. Four strobe cycles are required to load the new data. When the fifth ST5 signal occurs, U10 is empted of data and all its outputs are 0. RG is then inhibited by U11 and the clocking of data ceases. The busy flags are cleared from the DOU output and the data can be read. ARM INPUT may go to 0 at any time in the cycle but it must go to 0 before a data updata can be externally commanded. If desired, the DOU will automatically update at the end of each instrument measurement. If FREE RUN is allowed to be high, the DOU will automatically up date the data after each measurement.

002-10. Busy Flag

002-11. The updating period of the DOU is signified by the BUSY (pin 2) and BUSY (pin 4) outputs from the DOU. During this period the data on the output connector pins will be changing to reflect the updated input. Either the positive true BUSY or negative true BUSY flag can be used to inhibit the data recording instrument during this time period.

002-12. Polarity Flag

002-13. The polarity of the dc voltage input to the A-D Converter determines which polarity sign will be presented at DOU output pin 3; pin 5 provides POL in Model 8800A only. A positive dc level at the converter will cause DOU output pin 3 to go to logic 1 and pin 5 (8800A) to to to logic 0. A negative converter input will cause the opposite logic level output from each pin.

002-14. Overload Indication

002-15. The DOU provides a single-bit output indication of a display overload condition. When the digit count exceeds the display capacity pin 6 of the DOU output connector changes from a logic 0 to logic1.

Table 002-1. DOU Data Identification

DOU DATA NAME	DOU PIN NO.		DOU DATA NAME
+5V	1	A	LOGIC RETURN
BUSY FLAG	2	B	ARM ENABLE
POL FLAG	3	C	ARM INPUT
$\overline{\text{BUSY}}$ FLAG	4	D	FREE RUN
(8800A) $\overline{\text{POL}}$ FLAG	5	E	NOT USED
OVERLOAD Ω	6	F	a RANGE CODE
RANGE CODE b	7	H	c RANGE CODE
W6	8	J	X6 } 4 BITS
Y6	9	K	Z6 } LSD (8800A)
W5	10	L	X5 } 4 BITS
Y5	11	M	Z5 } LSD (8600A)
W4	12	N	X4 } 4 BITS
Y4	13	P	Z4 } 4SD
W3	14	R	X3 } 4 BITS
Y3	15	S	Z3 } 3SD
W2	16	T	X2 } 4 BITS
Y2	17	U	Z2 } 2SD
(GND) W1	18	V	X1 (GND } 4 BITS MSD
(GND) Y1	19	W	Z1 } ONE ACTIVE
	20	X	NOT USED
	21	Y	NOT USED
NOT USED	22	Z	NOT USED

REMARKS

BCD BIT WEIGHT
W = 8
X = 4
Y = 2
Z = 1

RANGE	CODE		
	a	b	c
200Ω	0	0	1
2K	0	1	0
20K	0	1	1
200K	1	0	0
2000K	1	0	1
20MΩ	1	1	0

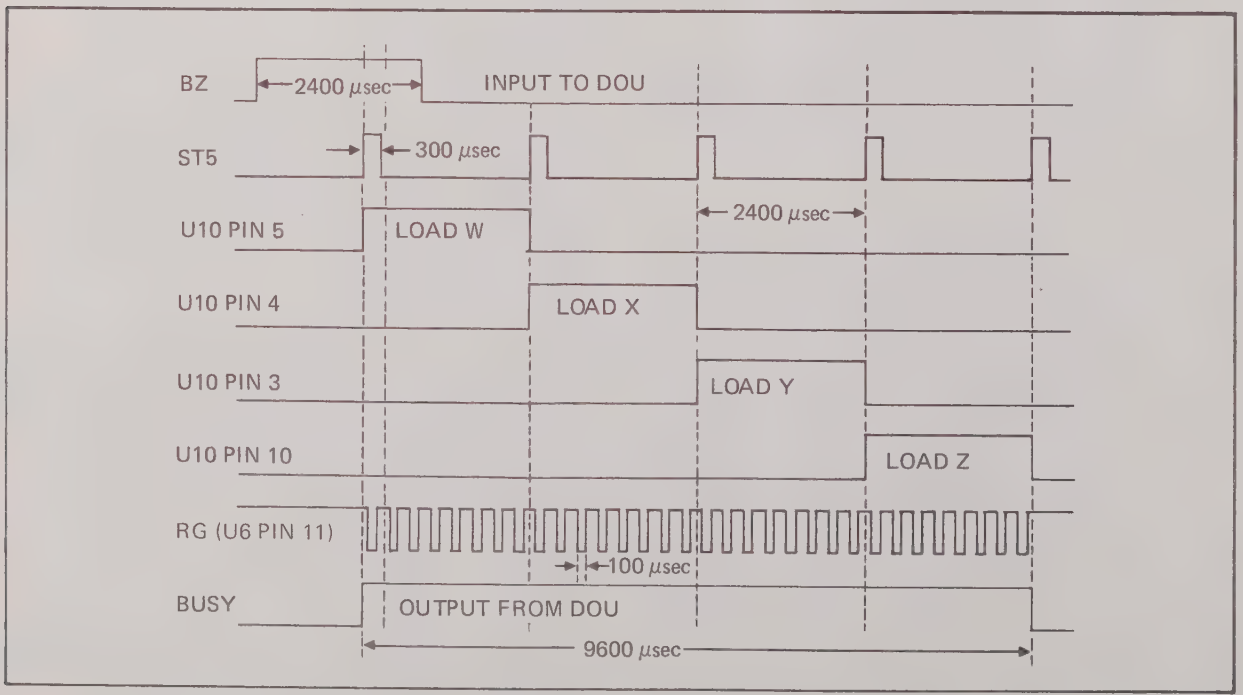


Figure 002-1. DOU Timing Diagram

002-16. Range Code

002-17. The instrument range in presented in three-bit bed format at DOU output connector pins H, 7, and F. The output code representing each range is presented in Table 002-1.

002-18. Display Digit

002-19. The numerical value of each digit of the instrument display is presented in a four-bit bed format at the DOU output connector. The connector pin assignments for each significant digit of the display are provided in Table 6-2. The most significant digit (DOU connector pins 18, 19, V, and W) needs only one active bit to represent the two display digits, 1 or 0. The three remaining bits are connected to ground in the DOU and, in most cases, the corresponding bits in the remote display unit must also be grounded to represent a logic 0.

002-20. DOU Interface Cable

002-21. A mating DOU connector is supplied with the DOU option for fabrication of a custom interface cable. Use the following procedure when constructing the interface cable:

a. Assemble the following equipment:

   1. Teflon or vinyl insulated wire, 26 gauge, 31 pieces cut to the desired length.
   2. Sleeving, #16 for vinyl wire, or #18 for teflon.
   3. Rosin cor solder, 60/40.
   4. Wire strippers.
   5. Soldering iron, pencil-type (45W max.)
   6. DOU mating connector.
   7. Mating connector for interface instrument.

b. Strip one-half inch of insulation from the DOU connector end of the wires and tin each wire.

c. Cut 31 pieces of sleeving one-half inch long.

d. Place one piece of sleeving over each prepared wire.

e. Solder a connector contact pin to each wire.

f. Slide the sleeving over each solder connection.

g. Insert on connector contact pin into each DOU mating connector position corresponding to the desired data output.

h. Prepare the mating connector for the interface instrument. Ensure that the data line connections, at the interface instrument mating connector, place the DOU data on the correct pins.

002-22. THEORY OF OPERATION

002-23. The DOU receives four lines (W, X, Y, and Z) or data, in character serial format, from the instrument; each line containing eight bits of data. The data lines are seqentially gated, by four successive strobe 5 signals, across an isolation circuit to a series of shift registers. The data from the shift registers is applied through inverting amplifiers to the DOU output connector. A schematic of the DOU circuitry is provided in Figure 002-2.

002-24. The external trigger synchronizing circuit produces an enabling signal that allows the shift registers to accept new data. When a logic 1 is applied to the DOU connector pin D (FREE RUN) the sync circuit will enable the shift registers to update the data with each new input from the instrument. By applying a logic 0 to pin D and a logic 1 to pin B (ARM ENABLE), a positive trigger at pin C (ARM INPUT) will cause the sync dircuit to enable the shift registers for the first complete data input that occurs after the arm-input-trigger.

002-25. MAINTENANCE

002-26. Maintenance requirements for the DOU are limited to a periodic performance test. The test is accomplished under normal operating conditions and consists of verifying that display data is accurately reapeated by a known-good output device. Since the DOU output data is in BCD format, a check of the 8, 4, 2, 1, and 0 digits is sufficient to verify proper operation.

002-27. LIST OF REPLACEABLE PARTS

002-28. Table 002-2 lists the replaceable parts for the -002 Option. For an explanation of the column headings and ordering information, refer to Section 5 of this manual.

CAUTION

Indicated devices are subject to damage by static discharge.

Table 002-2. OPTION -02 DOU PCB ASSEMBLY

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
-02	DOU PCB ASSEMBLY FIGURE 002-2 (8800A-4005T)	ORDER	BY	OPTION -02			
C1	CAP, ELECT, 200 UF +50/-10%, 10V	236935	73445	ET221X010A5	2	1	
C2	CAP, PLSTC, 0.022 UF +/-10%, 50V	271577	06001	75F1RA222	1		
C3	CAP, ELECT, 200 UF +50/-10%, 10V	236935	73445	ET221X010A5	REF		
C4	CAP, FXD, CER, 0.05 UF +80/-10%, 25V	148924	32897	5855Y5U503Z	1		
CR1	RECTIFIER, BRIDGE	296509	51605	FB100	1	1	
CR2	DIODE, ZENER, 5.6V	277236	07910	1N752A	1	1	
MP1	CABLE, FLAT	385922	08261	5112-007.25X			
Q1	XSTR, SI, NPN	218396	04713	2N3904	3	1	
Q2	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q3	XSTR, SI, PNP	195974	04713	2N3906	2	1	
Q4	XSTR, SI, PNP	195974	04713	2N3906	REF		
Q5	XSTR, SI, NPN	218396	04713	2N3904	REF		
R15	RES, CAR DEP, 1K +/-5%, 1/4W	343426	TOYO	R251025	2		
R16	RES, CAR DEP, 1K +/-5%, 1/4W	343426	TOYO	R251025	REF		
R17	RES, COMP, 4.7M +/-5%, 1/4W	220046	01121	CB4755	2		
R18	RES, COMP, 4.7M +/-5%, 1/4W	220046	01121	CB4755	REF		
RN1	RES, NETWORK	385930	89536	385930	1	1	
T1	XFMR, POWER	374652	89536	374652	1		
U1	IC,C-MOS, DUAL, 4-BIT STATIC SHFT RGSTR	340125	04713	MC14015CP	5	1	
U2	IC,C-MOS, DUAL, 4-BIT STATIC SHFT RGSTR	340125	04713	MC14015CP	REF		
U3	IC,C-MOS, DUAL, 4-BIT STATIC SHFT RGSTR	340125	04713	MC14015CP	REF		
U4	IC,C-MOS, DUAL, 4-BIT STATIC SHFT RGSTR	340125	04713	MC14015CP	REF		
U5	IC, C-MOS, DUAL, TYPE "D" FLIP-FLOP	340117	04713	MC14013CL	1	1	
U6	IC, C-MOS, NOR GATES	355172	04713	MC14001CL	1	1	
U7	IC, C-MOS, HEX, BUFFER/INVERTER	381848	49671	CD4049AE	6	1	
U8	IC, C-MOS, HEX, BUFFER/INVERTER	381848	49671	CD4049AE	REF		
U9	IC, C-MOS, QUAD, BILATERAL SW	363838	49671	CD4016AE	1	1	
U10	IC,C-MOS, DUAL, 4-BIT STATIC SHFT RGSTR	340125	04713	MC14015CP	REF		
U11	IC, C-MOS, DUAL, 4-INPUT, NOR GATES	363820	49671	CD4002AE	1	1	
U12	IC, C-MOS, HEX, BUFFER/INVERTER	381848	49671	CD4049AE	REF		
U13	IC, C-MOS, HEX, BUFFER/INVERTER	381848	49671	DC4049AE	REF		
U14	IC, C-MOS, HEX, BUFFER/INVERTER	381848	49671	DC4049AE	REF		
U16	OPTO ISOLATOR, PHOTO XSTR	380014	86539	MCT2	2	1	
U17	OPTO ISOLATOR, PHOTO XSTR	380014	86539	MCT2	REF		
XU1	SOCKET, IC, 16 PIN	276535	23880	TSA2900-16W	11		
XU2	SOCKET, IC, 16 PIN	276535	23880	TSA2900-16W	REF		

Table 002-2. OPTION –02 DOU PCB ASSEMBLY (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
XU3	SOCKET, IC, 16 PIN	276535	23880	TSA2900-16W	REF		
XU4	SOCKET, IC, 16 PIN	276535	23880	TSA2900-16W	REF		
XU5	SOCKET, IC, 14 PIN	276527	23880	TSA2900-14W			4
XU6	SOCKET, IC, 14 PIN	276527	23880	TSA2900-14W	REF		
XU7	SOCKET, IC, 16 PIN	276535	23880	TSA2900-16W	REF		
XU8	SOCKET, IC, 16 PIN	276535	23880	TSA2900-16W	REF		
XU9	SOCKET, IC, 14 PIN	276527	23880	TSA2900-14W	REF		
XU10	SOCKET, IC, 16 PIN	276535	23880	TSA2900-16W	REF		
XU11	SOCKET, IC, 14 PIN	276527	23880	TSA2900-14W	REF		
XU12	SOCKET, IC, 16 PIN	276535	23880	TSA2900-16W	REF		
XU13	SOCKET, IC, 16 PIN	276535	23880	TSA2900-16W	REF		
XU14	SOCKET, IC, 16 PIN	276535	23880	TSA2900-16W	REF		
XU15	SOCKET, IC, 16 PIN	276535	23880	TSA2900-16W	REF		

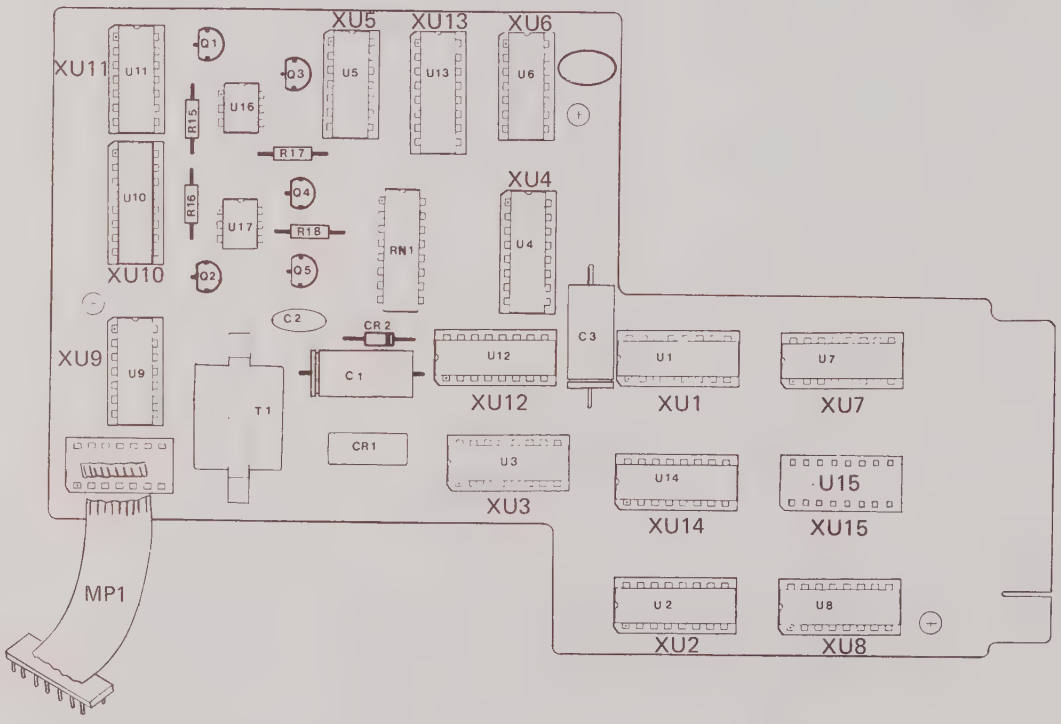


Figure 002-2. OPTION –02 DOU PCB ASSEMBLY

Section 7
General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable Parts contained in Section 5. The following information is presented in this section:

List of Abbreviations

Federal Supply Codes for Manufacturers

Fluke Technical Service Centers - U.S. and Canada

Fluke Technical Service Centers - International

Sales Representatives - U.S. and Canada

Sales Representatives - International

List of Abbreviations and Symbols

A or amp	ampere
ac	alternating current
af	audio frequency
a/d	analog-to-digital
assy	assembly
AWG	american wire gauge
B	bel
bcd	binary coded decimal
°C	Celsius
cap	capacitor
ccw	counterclockwise
cer	ceramic
cermet	ceramic to metal(seal)
ckt	circuit
cm	centimeter
cmrr	common mode rejection ratio
comp	composition
cont	continue
crt	cathode-ray tube
cw	clockwise
d/a	digital-to-analog
dac	digital-to-analog converter
dB	decibel
dc	direct current
dmm	digital multimeter
dvm	digital voltmeter
elect	electrolytic
ext	external
F	farad
°F	Fahrenheit
FET	Field-effect transistor
ff	flip-flop
freq	frequency
FSN	federal stock number
g	gram
G	giga (10^9)
gd	guard
Ge	germanium
GHz	gigahertz
gmv	guaranteed minimum value
gnd	ground
H	henry
hd	heavy duty
hf	high frequency
Hz	hertz
IC	integrated circuit
if	intermediate frequency
in	inch(es)
intl	internal
I/O	input/output
k	kilo (10^3)
kHz	kilohertz
kΩ	kilohm(s)
kV	kilovolt(s)
lf	low frequency
LED	light-emitting diode
LSB	least significant bit
LSD	least significant digit
M	mega (10^6)
m	milli (10^{-3})
mA	milliampere(s)
max	maximum
mf	metal film
MHz	megahertz
min	minimum
mm	millimeter
ms	millisecond
MSB	most significant bit
MSD	most significant digit
MTBF	mean time between failures
MTTR	mean time to repair
mV	millivolt(s)
mv	multivibrator
MΩ	megohm(s)
n	nano (10^{-9})
na	not applicable
NC	normally closed
(–) or neg	negative
NO	normally open
ns	nanosecond
opnl ampl	operational amplifier
p	pico (10^{-12})
para	paragraph
pcb	printed circuit board
pF	picofarad
pn	part number
(+) or pos	positive
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
PROM	programmablle read-only memory
psi	pound-force per square inch
RAM	random-access memory
rf	radio frequency
rms	root mean square
ROM	read-only memory
s or sec	second (time)
scope	oscilloscope
SH	shield
SI	silicon
serno	serial number
sr	shift register
Ta	tantalum
tb	terminal board
tc	temperature coefficient or temperature compensating
tcxo	temperature compensated crystal oscillator
tp	test point
u or μ	micro (10^{-6})
uhf	ultra high frequency
us or μs	microsecond(s) (10^{-6})
uut	unit under test
V	volt
v	voltage
var	variable
vco	voltage controlled oscillator
vhf	very high frequency
vlf	very low frequency
W	watt(s)
ww	wire wound
xfmr	transformer
xstr	transistor
xtal	crystal
xtlo	crystal oscillator
Ω	ohm(s)
μ	micro (10^{-6})

Federal Supply Codes for Manufacturers

00213
Nytronics Comp. Group Inc.
Subsidiary of Nytronics Inc.
Formerly Sage Electronics
Rochester, New York

00327
Welwyn International, Inc.
Westlake, Ohio

00656
Aerovox Corp.
New Bedford, Massachusetts

00686
Film Capacitors, Inc.
Passaic, New Jersey

00779
AMP Inc.
Harrisburg, Pennsylvania

01121
Allen-Bradley Co.
Milwaukee, Wisconsin

01281
TRW Electronic Comp.
Semiconductor Operations
Lawndale, California

01295
Texas Instruments, Inc.
Semiconductor Group
Dallas, Texas

01537
Motorola Communications &
Electronics Inc.
Franklin Park, Illinois

01686
RCL Electronics Inc.
Manchester, New Hampshire

01730
Replaced by 73586

01884
Use 56289
Sprague Electric Co.
Dearborn Electronic Div.
Lockwood, Florida

02114
Ferroxcube Corp.
Saugerties, New York

02131
General Instrument Corp.
Harris ASW Div.
Westwood, Maine

02395
Rason Mfg. Co.
Brooklyn, New York

02533
Snelgrove, C.R. Co., Ltd.
Don Mills, Ontario, Canada
M3B 1M2

02606
Fenwal Labs
Div. of Travenal Labs.
Morton Grove, Illinois

02660
Bunker Ramo Corp., Conn Div.
Formerly Amphenol-Borg
Electric Corp.
Broadview, Illinois

02799
Areo Capacitors, Inc.
Chatsworth, California

03508
General Electric Co.
Semiconductor Products
Syracuse, New York

03614
Replaced by 71400

03651
Replaced by 44655

03797
Eldema Div.
Genisco Technology Corp.
Compton, California

03877
Transistron Electronic Corp.
Wakefield, Massachusetts

03888
KDI Pyrofilm Corp.
Whippany, New Jersey

03911
Clairex Electronics Div.
Clairex Corp.
Mt. Vernon, New York

03980
Muirhead Inc.
Mountainside, New Jersey

04009
Arrow Hart Inc.
Hartford, Connecticut

04062
Replaced by 72136

04202
Replaced by 81312

04217
Essex International Inc.
Wire & Cable Div.
Anaheim, California

04221
Aemco, Div. of
Midtex Inc.
Mankato, Minnesota

04222
AVX Ceramics Div.
AVX Corp.
Myrtle Beach, Florida

04423
Telonic Industries
Laguna Beach, California

04645
Replaced by 75376

04713
Motorola Inc. Semiconductor
Products
Phoenix, Arizona

04946
Standard Wire & Cable
Los Angeles, California

05082
Replaced by 94988

05236
Jonathan Mfg. Co.
Fullerton, California

05245
Components Corp. now
Corcom, Inc.
Chicago, Illinois

05277
Westinghouse Electric Corp.
Semiconductor Div.
Youngwood, Pennsylvania

05278
Replaced by 43543

05279
Southwest Machine &
Plastic Co.
Glendora, California

05397
Union Carbide Corp.
Materials Systems Div.
New York, New York

05571
Use 56289
Sprague Electric Co.
Pacific Div.
Los Angeles, California

05574
Viking Industries
Chatsworth, California

05704
Replaced by 16258

05820
Wakefield Engineering Inc.
Wakefield, Massachusetts

06001
General Electric Co.
Electronic Capacitor &
Battery Products Dept.
Columbia, South Carolina

06136
Replaced by 63743

06383
Panduit Corp.
Tinley Park, Illinois

06473
Bunker Ramo Corp.
Amphenol SAMS Div.
Chatsworth, California

06555
Beede Electrical Instrument Co.
Penacook, New Hampshire

06739
Electron Corp.
Littleton, Colorado

06743
Clevite Corp.
Cleveland, Ohio

06751
Components, Inc. Semcor Div.
Phoenix, Arizona

06860
Gould Automotive Div.
City of Industry, California

06961
Vernitron Corp., Piezo
Electric Div.
Formerly Clevite Corp., Piezo
Electric Div.
Bedford, Ohio

06980
Eimac Div.
Varian Associates
San Carlos, California

07047
The Ross Milton Co.
South Hampton, Pennsylvania

07115
Replaced by 14674

07138
Westinghouse Electric Corp.,
Electronic Tube Div.
Horsehead, New York

07233
TRW Electronic Components
Cinch Graphic
City of Industry, California

07256
Silicon Transistor Corp.
Div. of BBF Group Inc.
Chelmsford, Massachusetts

07261
Aumet Corp.
Culver City, California

07263
Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344
Bircher Co., Inc.
Rochester, New York

07597
Burndy Corp.
Tape/Cable Div.
Rochester, New York

07792
Lerma Engineering Corp.
Northampton, Massachusetts

07910
Teledyne Semiconductor
Formerly Continental Device
Hawthorne, California

07933
Use 49956
Raytheon Co.
Semiconductor Div. HQ
Mountain View, California

08225
Industro Transistor Corp.
Long Island City, New York

Federal Supply Codes for Manufacturers (cont)

08261
Spectra Strip Corp.
Garden Grove, California

08530
Reliance Mica Corp.
Brooklyn, New York

08806
General Electric Co.
Miniature Lamp Products Dept
Cleveland, Ohio

08863
Nylomatic Corp.
Norrisville, Pennsylvania

08988
Use 53085
Skottie Electronics Inc.
Archbald, Pennsylvania

09214
G.E. Co. Semi-Conductor
Products Dept.
Power Semi-Conductor
Products OPN Sec.
Auburn, New York

09353
C and K Components
Watertown, Massachusetts

09423
Scientific Components, Inc.
Santa Barbara, California

09922
Burndy Corp.
Norwalk, Connecticut

09969
Dale Electronics Inc.
Yankton, S. Dakota

10059
Barker Engineering Corp.
Formerly Amerace, Amerace
ESNA Corp.
Kenilworth, New Jersey

11236
CTS of Berne
Berne, Indiana

11237
CTS Keene Inc.
Paso Robles, California

11358
CBS Electronic Div.
Columbia Broadcasting System
Newburyport, Minnesota

11403
Best Products Co.
Chicago, Illinois

11503
Keystone Columbia Inc.
Warren, Michigan

11532
Teledyne Relays
Hawthorne, California

11711
General Instrument Corp.
Rectifier Division
Hicksville, New York

11726
Qualidyne Corp.
Santa Clara, California

12014
Chicago Rivet & Machine Co.
Bellwood, Illinois

12040
National Semiconductor Corp.
Danburry, Connecticut

12060
Diodes, Inc.
Chatsworth, California

12136
Philadelphia Handle Co.
Camden, New Jersey

12300
Potter-Brumfield Div.
AMF Canada LTD.
Guelph, Ontario, Canada

12323
Presin Co., Inc.
Shelton, Connecticut

12327
Freeway Corp. formerly
Freeway Washer & Stamping Co.
Cleveland, Ohio

12443
The Budd Co. Polychem Products
Plastic Products Div.
Bridgeport, Pennsylvania

12615
U.S. Terminals Inc.
Cincinnati, Ohio

12617
Hamlin Inc.
Lake Mills, Wisconsin

12697
Clarostat Mfg. Co.
Dover, New Hampshire

12749
James Electronics
Chicago, Illinois

12856
Micrometals
Sierra Madre, California

12954
Dickson Electronics Corp.
Scottsdale, Arizona

12969
Unitrode Corp.
Watertown, Massachusetts

13103
Thermalloy Co., Inc.
Dallas, Texas

13327
Solitron Devices Inc.
Tappan, New York

13511
Amphenol Cadre Div.
Bunker-Ramo Corp.
Los Gatos, California

13606
Use 56289
Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839
Replaced by 23732

14099
Semtech Corp.
Newbury Park, California

14140
Edison Electronic Div.
Mc Gray-Edison Co.
Manchester, New Hampshire

14193
Cal-R-Inc. formerly
California Resistor, Corp.
Santa Monica, California

14298
American Components, Inc.
an Insilco Co.
Conshohocken, Pennsylvania

14655
Cornell-Dublier Electronics
Division of Federal Pacific
Electric Co. Govt. Control Dept.
Newark, New Jersey

14752
Electro Cube Inc.
San Gabriel, California

14869
Replaced by 96853

14936
General Instrument Corp.
Semi Conductor Products Group
Hicksville, New York

15636
Elec-Trol Inc.
Saugus, California

15801
Fenwal Electronics Inc.
Div. of Kidde Walter and Co., Inc.
Framingham, Massachusetts

15818
Teledyne Semiconductors,
formerly Amelco Semiconductor
Mountain View, California

15849
Litton Systems Inc. Useco Div.
formerly Useco Inc.
Van Nuys, California

15898
International Business
Machines Corp.
Essex Junction, Vermont

15909
Replaced by 14140

16258
Space-Lok Inc.
Burbank, California

16299
Corning Glass
Electronic Components Div.
Raleigh, North Carolina

16332
Replaced by 28478

16473
Cambridge Scientific Ind.
Div. of Chemed Corporation
Cambridge, Maryland

16742
Paramount Plastics
Fabricators, Inc.
Downey, California

16758
Delco Electronics
Div. of General Motors Corp.
Kokomo, Indiana

17001
Replaced by 71468

17069
Circuit Structures Lab.
Burbank, California

17338
High Pressure Eng. Co., Inc.
Oklahoma City, Oklahoma

17545
Atlantic Semiconductors, Inc.
Asbury Park, New Jersey

17856
Siliconix, Inc.
Santa Clara, California

17870
Replaced by 14140

18178
Vactec Inc.
Maryland Heights, Missouri

18324
Signetics Corp.
Sunnyvale, California

18612
Vishay Resistor Products Div.
Vishay Intertechnology Inc.
Malvern, Pennsylvania

18736
Voltronics Corp.
Hanover, New Jersey

18927
GTE Sylvania Inc.
Precision Material Group
Parts Division
Titusville, Pennsylvania

19451
Perine Machinery & Supply Co.
Seattle, Washington

19701
Electro-Midland Corp.
Mepco-Electra Inc.
Mineral Wells, Texas

20584
Enochs Mfg. Inc.
Indianapolis, Indiana

Federal Supply Codes for Manufacturers (cont)

20891
Self-Organizing Systems, Inc.
Dallas, Texas

21604
Bucheye Stamping Co.
Columbus, Ohio

21845
Solitron Devices Inc.
Transistor Division
Riveria Beach, Florida

22767
ITT Semiconductors
Palo Alto, California

23050
Product Comp. Corp.
Mount Vernon, New York

23732
Tracor Inc.
Rockville, Maryland

23880
Stanford Applied Engrng.
Santa Clara, California

23936
Pamotor Div., Wm. J. Purdy Co.
Burlingame, California

24248
Replaced by 94222

24355
Analog Devices Inc.
Norwood, Massachusetts

24655
General Radio
Concord, Massachusetts

24759
Lenox-Fugle Electronics Inc.
South Plainfield, New Jersey

25088
Siemen Corp.
Isilen, New Jersey

25403
Amperex Electronic Corp.
Semiconductor &
Micro-Circuits Div.
Slatersville, Rhode Island

27014
National Semiconductor Corp.
Santa Clara, California

27264
Molex Products
Downers Grove, Illinois

28213
Minnesota Mining & Mfg. Co.
Consumer Products Div.
St. Paul, Minnesota

28425
Serv-/-Link formerly
Bohannan Industries
Fort Worth, Texas

28478
Deltrol Controls Div.
Deltrol Corporation
Milwaukee, Wisconsin

28480
Hewlett Packard Co.
Corporate HQ
Palo Alto, California

28520
Heyman Mfg. Co.
Kenilworth, New Jersey

29083
Monsanto, Co., Inc.
Santa Clara, California

29604
Stackpole Components Co.
Raleigh, North Carolina

30148
AB Enterprise Inc.
Ahoskie, North Carolina

30323
Illinois Tool Works, Inc.
Chicago, Illinois

31091
Optimax Inc.
Colmar, Pennsylvania

32539
Mura Corp.
Great Neck, New York

32767
Griffith Plastic Corp.
Burlingame, California

32879
Advanced Mechanical
Components
Northridge, California

32897
Erie Technological Products, Inc.
Frequency Control Div.
Carlisle, Pennsylvania

32997
Bourns Inc.
Trimpot Products Division
Riverside, California

33173
General Electric Co.
Products Dept.
Owensboro, Kentucky

34333
Silicon General
Westminister, California

34335
Advanced Micro Devices
Sunnyvale, California

34802
Electromotive Inc.
Kenilworth, New Jersey

37942
P.R. Mallory & Co., Inc.
Indianapolis, Indiana

42498
National Radio
Melrose, Massachusetts

43543
Nytronics Inc.
Transformer Co. Div.
Geneva, New York

44655
Ohmite Mfg. Co.
Skokie, Illinois

49671
RCA Corp.
New York, New York

49956
Raytheon Company
Lexington, Massachusetts

50088
Mostek Corp.
Carrollton, Texas

50579
Litronix Inc.
Cupertino, California

51605
Scientific Components Inc.
Linden, New Jersey

53021
Sangamo Electric Co.
Springfield, Illinois

54294
Cutler-Hammer Inc. formerly
Shallcross, A Cutter-Hammer Co.
Selma, North Carolina

55026
Simpson Electric Co.
Div. of Am. Gage and Mach. Co.
Elgin, Illinois

56289
Sprague Electric Co.
North Adams, Massachusetts

58474
Superior Electric Co.
Bristol, Connecticut

60399
Torin Corp. formerly
Torrington Mfg. Co.
Torrington, Connecticut

63743
Ward Leonard Electric Co., Inc.
Mount Vernon, New York

64834
West Mfg. Co.
San Francisco, California

65092
Weston Instruments Inc.
Newark, New Jersey

66150
Winslow Tele-Tronics Inc.
Eaton Town, New Jersey

70485
Atlantic India Rubber Works
Chicago, Illinois

70563
Amperite Company
Union City, New Jersey

70903
Belden Corp.
Geneva, Illinois

71002
Birnback Radio Co., Inc.
Freeport, New York

71400
Bussmann Mfg.
Div. of McGraw-Edison Co.
Saint Louis, Missouri

71450
CTS Corp.
Elkhart, Indiana

71468
ITT Cannon Electric Inc.
Santa Ana, California

71482
Clare, C.P. & Co.
Chicago, Illinois

71590
Centrelab Electronics
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707
Coto Coil Co., Inc.
Providence, Rhode Island

71744
Chicago Miniature Lamp Works
Chicago, Illinois

71785
TRW Electronics Components
Cinch Connector Operations Div.
Elk Grove Village
Chicago, Illinois

72005
Wilber B. Driver Co.
Newark, New Jersey

72092
Replaced by 06980

72136
Electro Motive Mfg. Co.
Williamantic, Connecticut

72259
Nytronics Inc.
Pelham Manor, New Jersey

72619
Dialight Div.
Amperex Electronic Corp.
Brooklyn, New York

72653
G.C. Electronics
Div. of Hydrometals, Inc.
Brooklyn, New York

72665
Replaced by 90303

72794
Dzus Fastener Co., Inc.
West Islip, New York

72928
Gulton Ind. Inc.
Gudeman Div.
Chicago, Illinois

Federal Supply Codes for Manufacturers (cont)

72982
Erie Tech. Products Inc.
Erie, Pennsylvania

73138
Bechman Instrument Inc.
Helipot Division
Fullerton, California

73293
Hughes Aircraft Co.
Electron Dynamics Div.
Torrance, California

73445
Amperex Electronic Corp.
Hicksville, New York

73559
Carling Electric Inc.
West Hartford, Connecticut

73586
Circle F Industries
Trenton, New Jersey

73734
Federal Screw Products, Inc.
Chicago, Illinois

73743
Fischer Special Mfg. Co.
Cincinnati, Ohio

73899
JFD Electronics Co.
Components Corp.
Brooklyn, New York

73949
Guardian Electric Mfg. Co.
Chicago, Illinois

74199
Quan Nichols Co.
Chicago, Illinois

74217
Radio Switch Corp.
Marlboro, New Jersey

74276
Signalite Div.
General Instrument Corp.
Neptune, New Jersey

74306
Piezo Crystal Co.
Carlisle, Pennsylvania

74542
Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970
Johnson E.F., Co.
Waseca, Minnesota

75042
TRW Electronics Components
IRC Fixed Resistors
Philadelphia, Pennsylvania

75376
Kurz-Kasch Inc.
Dayton, Ohio

75378
CTS Knights Inc.
Sandwich, Illinois

75382
Kulka Electric Corp.
Mount Vernon, New York

75915
Littlefuse Inc.
Des Plaines, Illinois

76854
Oak Industries Inc.
Switch Div.
Crystal Lake, Illinois

77342
AMF Inc.
Potter & Brumfield Div.
Princeton, Indiana

77638
General Instrument Corp.
Rectifier Division
Brooklyn, New York

77969
Rubbercraft Corp. of CA. LTD.
Torrance, California

78189
Shakeproof
Div. of Illinois Tool Works Inc.
Elgin, Illinois

78277
Sigma Instruments, Inc.
South Braintree, Massachusetts

78488
Stackpole Carbon Co.
Saint Marys, Pennsylvania

78553
Eaton Corp. Engineered
Fastener Div.
Tinnerman Plant
Cleveland, Ohio

79136
Waldes Kohinoor Inc.
Long Island City, New York

79497
Western Rubber Company
Goshen, Indiana

79963
Zierick Mfg. Corp.
Mt. Kisko, New York

80031
Electro-Midland Corp.
Mepco Div.
A North American Phillips Co.
Norristown, New Jersey

80145
LFE Corp., Process Control Div.
formerly API Instrument Co.
Chesterland, Ohio

80183
Use 56289
Sprague Products
North Adams, Massachusetts

80294
Bourns Inc., Instrument Div.
Riverside, California

80583
Hammarlund Mfg. Co., Inc.
Red Bank, New Jersey

80640
Arnold Stevens, Inc.
South Boston, Massachusetts

81073
Grayhill, Inc.
La Grange, Illinois

81312
Winchester Electronics
Div. of Litton Industries Inc.
Oakville, Connecticut

81483
Therm-O-Disc Inc.
Mansfield, Ohio

81483
International Rectifier Corp.
Los Angeles, California

81590
Korry Mfg. Co.
Seattle, Washington

81741
Chicago Lock Co.
Chicago, Illinois

82305
Palmer Electronics Corp.
South Gate, California

82389
Switchcraft Inc.
Chicago, Illinois

82415
North American Phillips
Controls Corp.
Frederick, Maryland

82872
Roanwell Corp.
New York, New York

82877
Rotron Inc.
Woodstock, New York

82879
ITT Royal Electric Div.
Pawtucket, Rhode Island

83003
Varo Inc.
Garland, Texas

83058
The Carr Co., United Can Div.
of TRW
Cambridge, Massachusetts

83298
Bendix Corp.
Electric Power Div.
Eatontown, New Jersey

83330
Herman H. Smith, Inc.
Brooklyn, New York

83478
Rubbercraft Corp.
of America, Inc.
West Haven, Connecticut

83594
Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740
Union Carbide Corp.
Battery Products Div.
formerly Consumer Products Div.
New York, New York

84171
Arco Electronics
Great Neck, New York

84411
TRW Electronic Components
TRW Capacitors
Ogallala, Nebraska

84613
Fuse Indicator Corp.
Rockville, Maryland

84682
Essex International Inc.
Industrial Wire Div.
Peabody, Massachusetts

86577
Precision Metal Products
of Malden Inc.
Stoneham, Massachusetts

86684
Radio Corp. of America
Electronic Components Div.
Harrison, New Jersey

86928
Seastrom Mfg. Co., Inc.
Glendale, California

87034
Illuminated Products Inc.
Subsidiary of Oak Industries Inc.
Anahiem, California

88219
Gould Inc.
Industrial Div.
Trenton, New Jersey

88245
Litton Systems Inc.
Useco Div.
Van Nuys, California

88419
Cornell-Dubilier Electronic Div.
Federal Pacific Co.
Fuquay-Varian, North Carolina

88486
Plastic Wire & Cable
Jewitt City, Connecticut

88690
Replaced by 04217

89536
John Fluke Mfg. Co., Inc.
Seattle, Washington

89730
G.E. Co., Newark Lamp Works
Newark, New Jersey

Federal Supply Codes for Manufacturers (cont)

90201
Mallory Capacitor Co.
Div. of P.R. Mallory Co., Inc.
Indianapolis, Indiana

90211
Use 56365
Square D Co.
Chicago, Illinois

90215
Best Stamp & Mfg. Co.
Kansas City, Missouri

90303
Mallory Battery Co.
Div. of Mallory Co., Inc.
Tarrytown, New York

91094
Essex International Inc.
Suglex/IWP Div.
Newmarket, New Hampshire

91293
Johanson Mfg. Co.
Boonton, New Jersey

91407
Replaced by 58474

91502
Associated Machine
Santa Clara, California

91506
Augat Inc.
Attleboro, Massachusetts

91637
Dale Electronics Inc.
Columbus, Nebraska

91662
Elco Corp.
Willow Grove, Pennsylvania

91737
Use 71468
Gremar Mfg. Co., Inc.
ITT Cannon/Gremar
Santa Ana, California

91802
Industrial Devices, Inc.
Edgewater, New Jersey

91833
Keystone Electronics Corp.
New York, New York

91836
King's Electronics Co., Inc.
Tuckahoe, New York

91929
Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934
Miller Electric Co., Inc.
Div. of Aunet
Woonsocket, Rhode Island

92194
Alpha Wire Corp.
Elizabeth, New Jersey

93332
Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145
Replaced by 49956

94154
Use 94988
Wagner Electric Corp.
Tung-Sol Div.
Newark, New Jersey

94222
Southco Inc. formerly
South Chester Corp.
Lester, Pennsylvania

95146
Alco Electronic Products Inc.
Lawrence, Massachusetts

95263
Leecraft Mfg. Co.
Long Island City, New York

95264
Replaced by 98278

95275
Vitramon Inc.
Bridgeport, Connecticut

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, Ohio

95348
Gordo's Corp.
Bloomfield, New Jersey

95354
Methode Mfg. Corp.
Rolling Meadows, Illinois

95712
Bendix Corp.
Electrical Components Div.
Microwave Devices Plant
Franklin, Indiana

95987
Weckesser Co. Inc.
Chicago, Illinois

96733
San Fernando Electric Mfg. Co.
San Fernando, California

96853
Gulton Industries Inc.
Measurement and Controls Div.
formerly Rustrak Instruments Co.
Manchester, New Hampshire

96881
Thomson Industries, Inc.
Manhasset, New York

97540
Master Mobile Mounts, Div. of
Whitehall Electronics Corp.
Ft. Meyers, Florida

97913
Industrial Electronic
Hardware Corp.
New York, New York

97945
Penwalt Corp.
SS White Industrial Products Div.
Piscataway, New Jersey

97966
Replaced by 11358

98094
Replaced by 49956

98159
Rubber-Teck, Inc.
Gardena, California

98278
Malco A Microdot Co., Inc.
Connector & Cable Div.
Pasadena, California

98291
Sealectro Corp.
Mamaroneck, New York

98388
Royal Industries
Products Div.
San Diego, California

98743
Replaced by 12749

98925
Replaced by 14433

99120
Plastic Capacitors, Inc.
Chicago, Illinois

99217
Bell Industries Elect.
Comp. Div.
formerly Southern Elect. Div.
Burbank, California

99392
STM
Oakland, California

99515
ITT Jennings Monrovia Plant
Div. of ITT Jennings formerly
Marshall Industries Capacitor Div.
Monrovia, California

99779
Use 29587
Bunker-Ramo Corp.
Barnes Div.
Landsdowne, Pennsylvania

99800
American Precision Industries Inc.
Delevan Division
East Aurora, New York

99942
Centrelab Semiconductor
Centrelab Electronics Div. of
Globe-Union Inc.
El Monte, California

Toyo Electronics
(R-Ohm Corp.)
Irvine, California

National Connector
Minneapolis, Minnesota

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Appendix 7A
Manual Change Information

INTRODUCTION

This appendix contains information necessary to backdate the manual to conform with earlier pcb configurations. To identify the configuration of the pcb's used in your instrument, refer to the revision letter (marked in ink) on the component side of each pcb assembly. Table 7A-1 defines the assembly revision levels documented in this manual.

NEWER INSTRUMENTS

As changes and improvements are made to the instrument, they are identified by incrementing the revision letter marked on the affected pcb assembly. These changes are documented on a supplemental change/errata sheet which, when applicable, is inserted at the front of the manual.

OLDER INSTRUMENTS

To backdate this manual to conform with earlier assembly revision levels, perform the changes indicated in Table 7A-1.

CHANGES

There are no backdating changes at this printing. All pcb assemblies are documented at their original revision level.

Table 7A-1. Manual Status and Backdating Information

Ref Or Option No.	Assembly Name	Fluke Part No.	* To adapt manual to earlier rev configurations perform changes in desending order (by no.), ending with change under desired rev letter																					
			—	A	B	C	D	E	F	G	H	J	K	L	M	N	P							AC
A1	MAIN PCB ASSEMBLY	366245																						X
A2A1	DISPLAY PCB ASSEMBLY	366278						X																
A3	OHMS CONVERTER PCB ASSEMBLY	456103		X																				
A4	AC CONVERTER PCB ASSEMBLY	462846				X																		
–02	DOU PCB ASSEMBLY	366369								X														

* X = The PCB revision levels documented in this manual.
● = These revision letters were never used in the instrument.
—= No revision letter on the PCB.

Section 8
Schematic Diagrams

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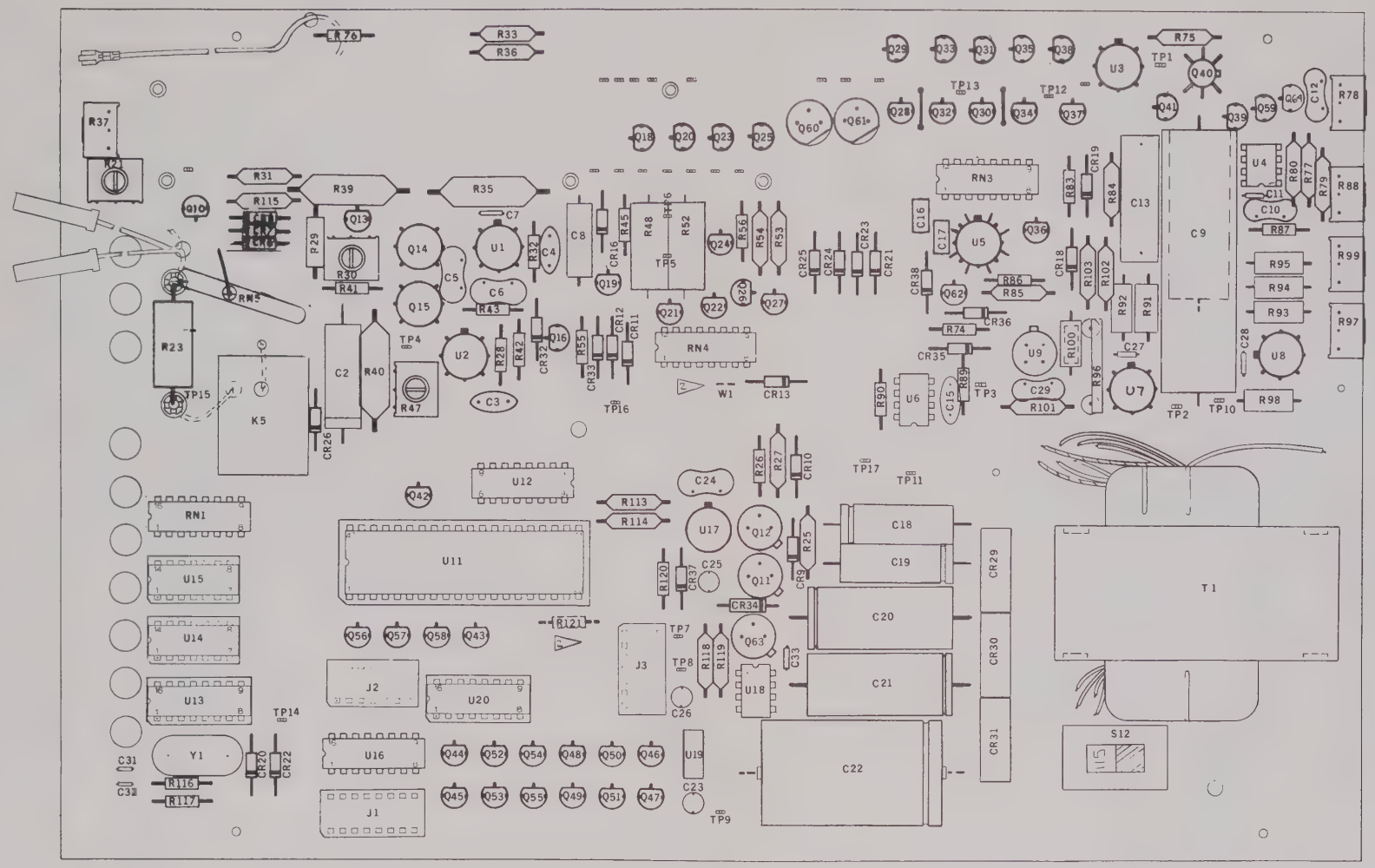
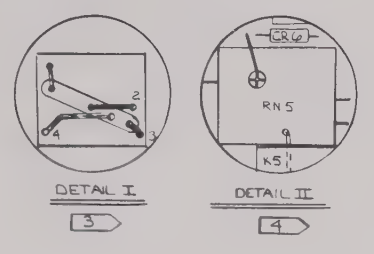
8-5	DATA OUTPUT UNIT PCB ASSEMBLY	8-12





NOTES: UNLESS OTHERWISE SPECIFIED

1. FOR ASSY DWG SEE 8800A-4001.

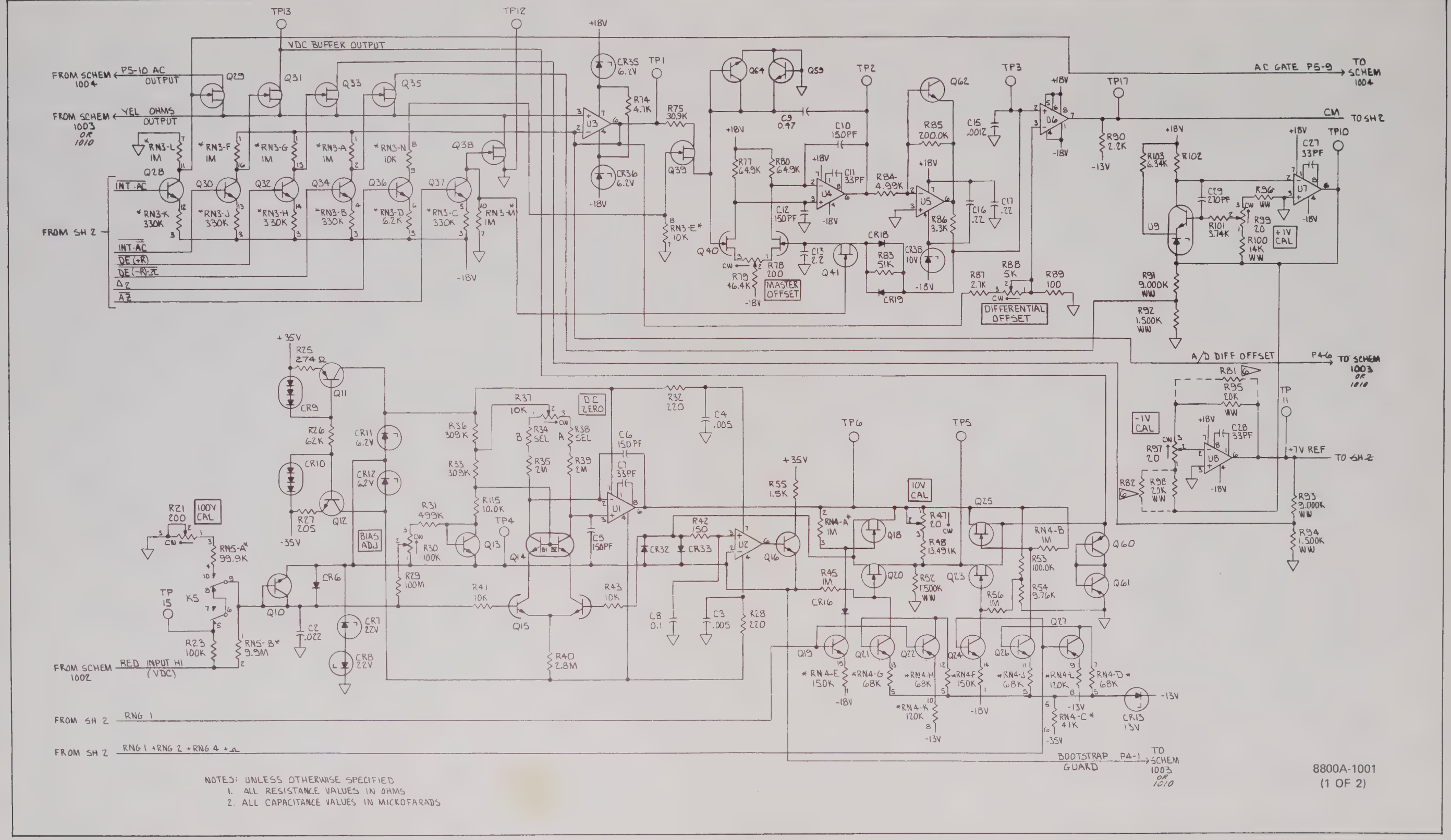
2 > RESISTOR R121 & JUMPER W1 ARE TO BE INSTALLED WHEN U11 IS A P-MOS IC (J F P/N 407734). WHEN C-MOS U11 IS INSTALLED (J F P/N 354985) R121 & W1 ARE OMITTED

3 > HEADER BOARD # 542019 IS AN OPTION.

4 > RESISTOR NETWORK 358002 MAY BE USED AS AN ALTERNATE.

8800A-1201

Figure 8-1. A1, MAIN PCB ASSEMBLY



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCE VALUES IN OHMS
2. ALL CAPACITANCE VALUES IN MICROFARADS

Figure 8-1. A1, MAIN PCB ASSEMBLY (cont)

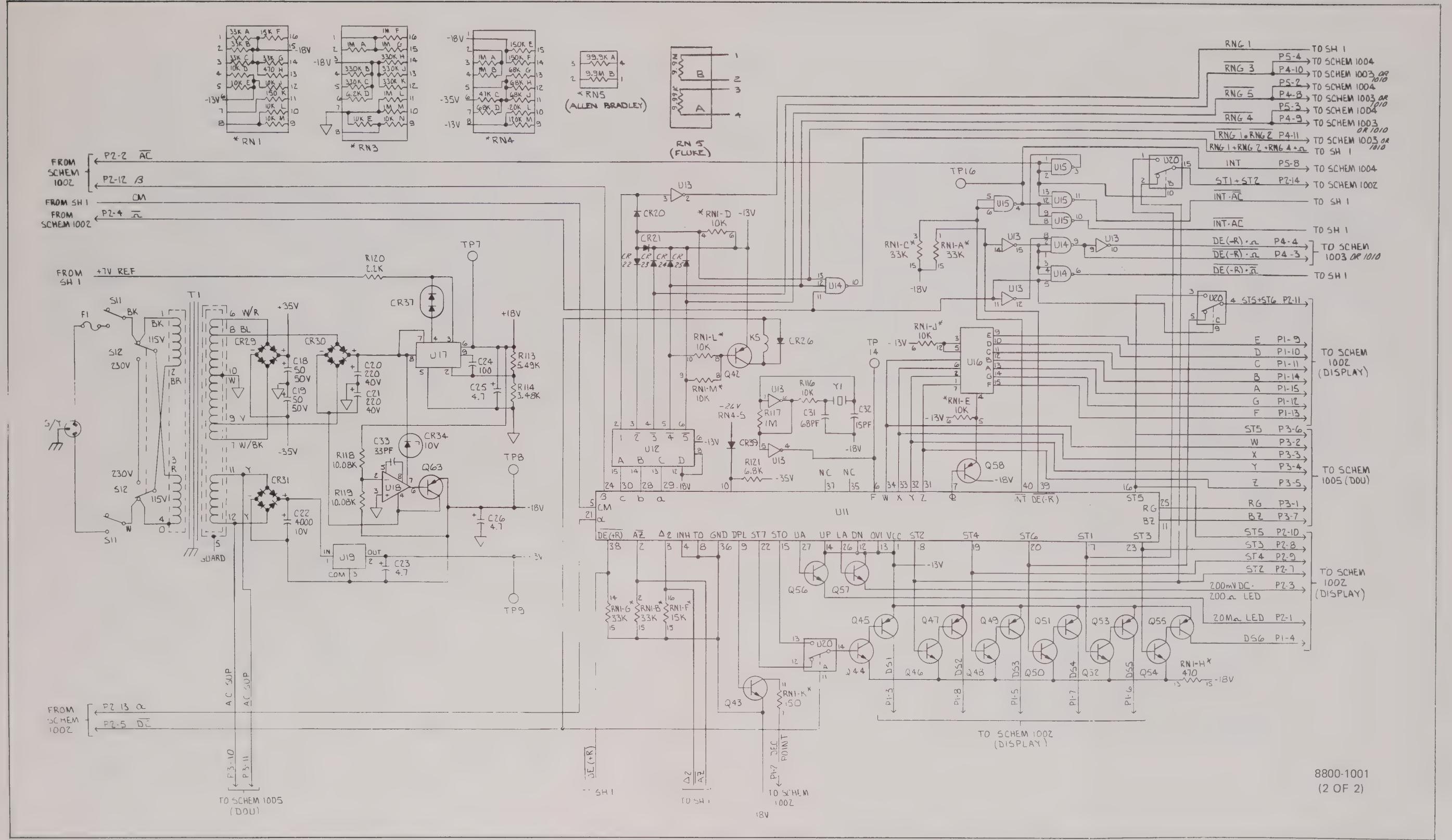
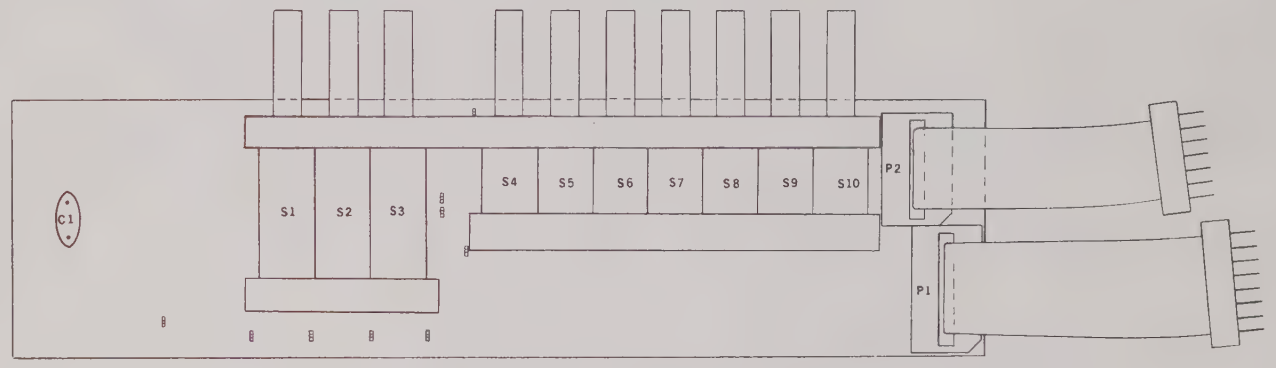
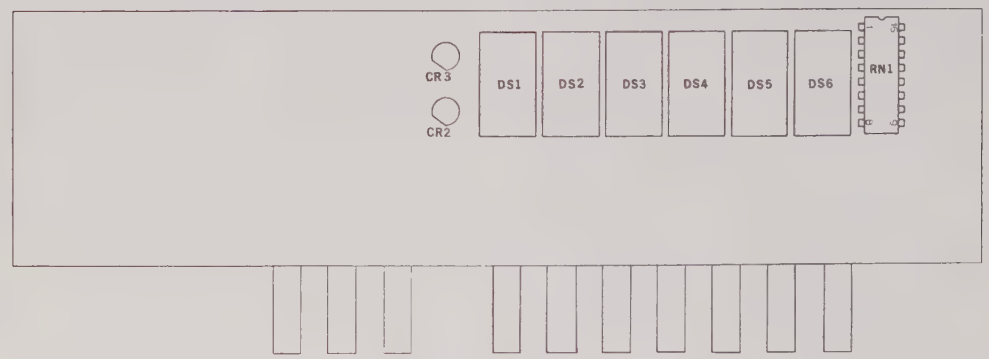


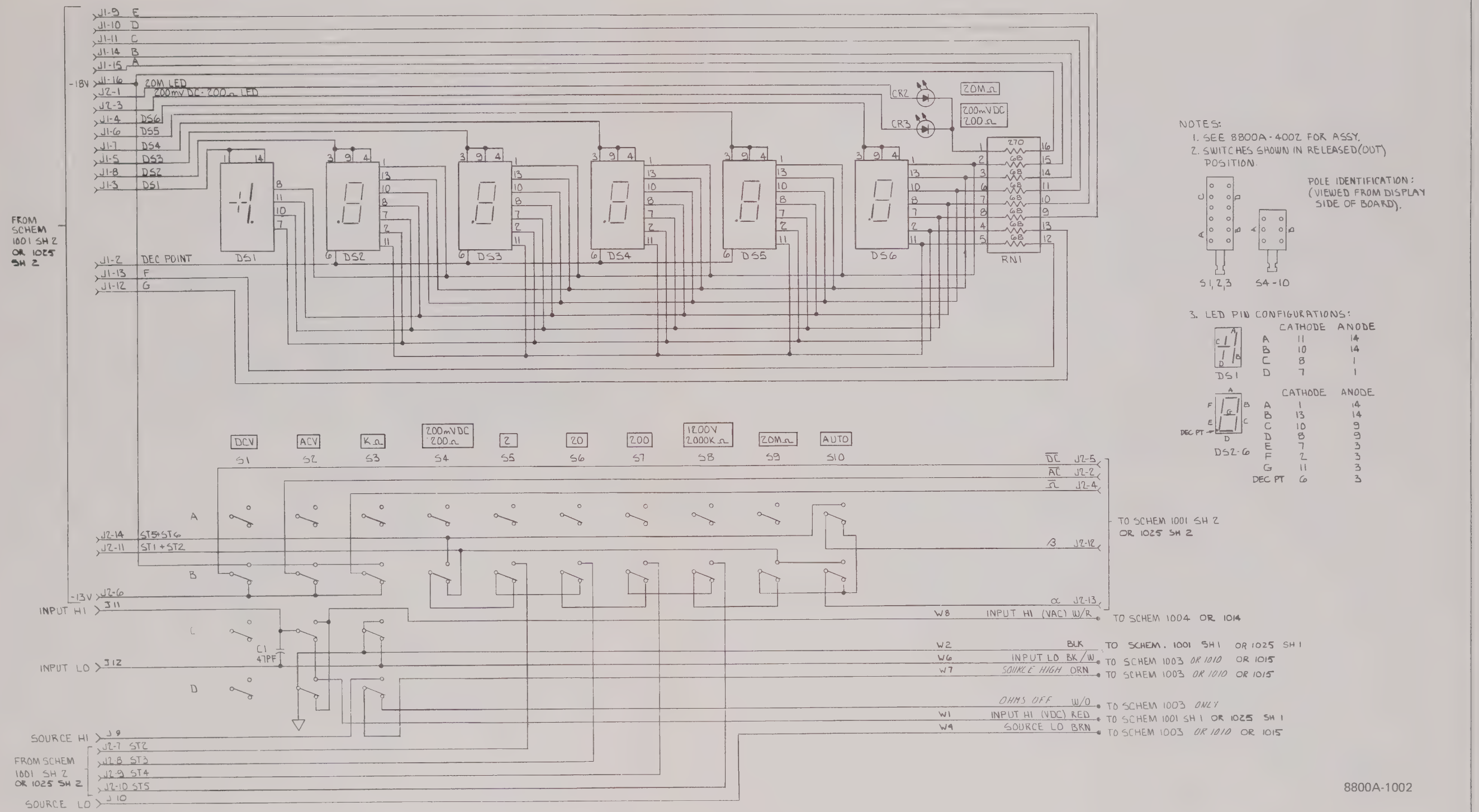
Figure 8-1. A1, MAIN PCB ASSEMBLY (cont)





8800A-1202

Figure 8-2. A2A1, DISPLAY PCB ASSEMBLY



NOTES:
1. SEE 8800A-400Z FOR ASSY.
2. SWITCHES SHOWN IN RELEASED (OUT) POSITION.

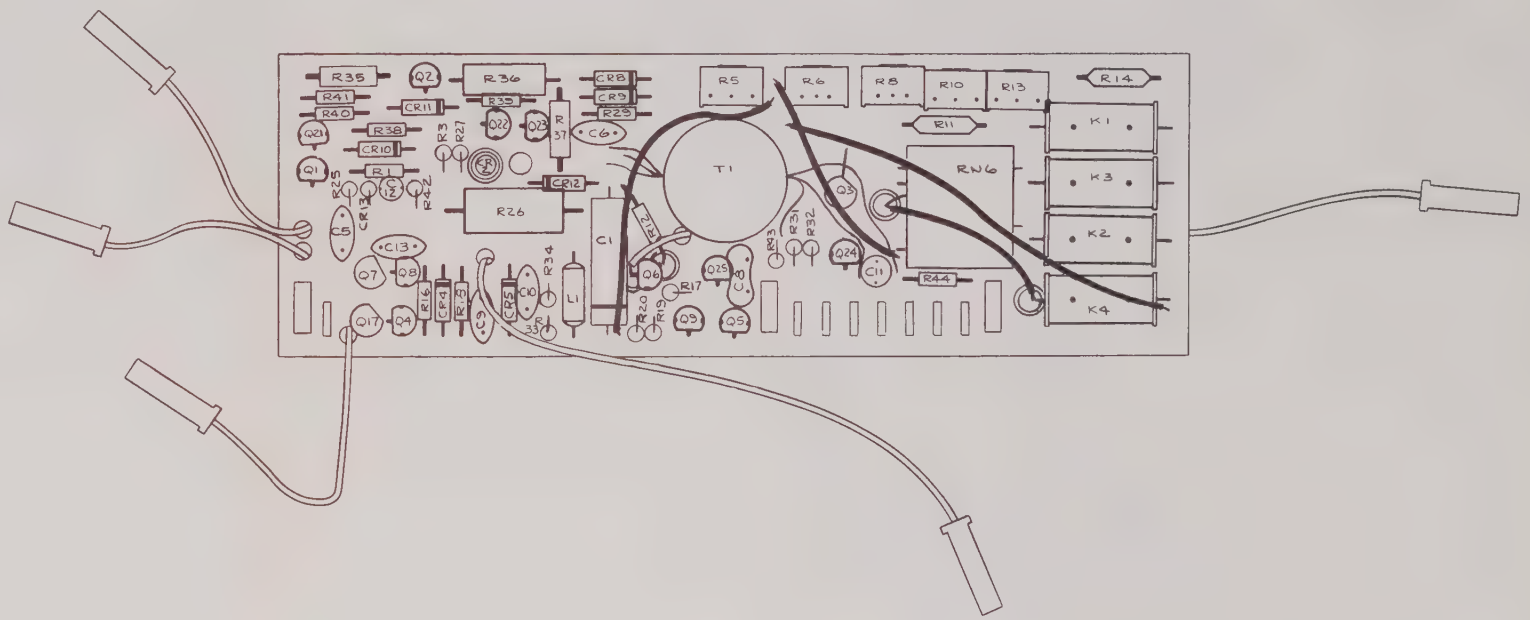
POLE IDENTIFICATION: (VIEWED FROM DISPLAY SIDE OF BOARD).

3. LED PIN CONFIGURATIONS:

	CATHODE	ANODE
A	11	14
B	10	14
C	8	1
D	7	1

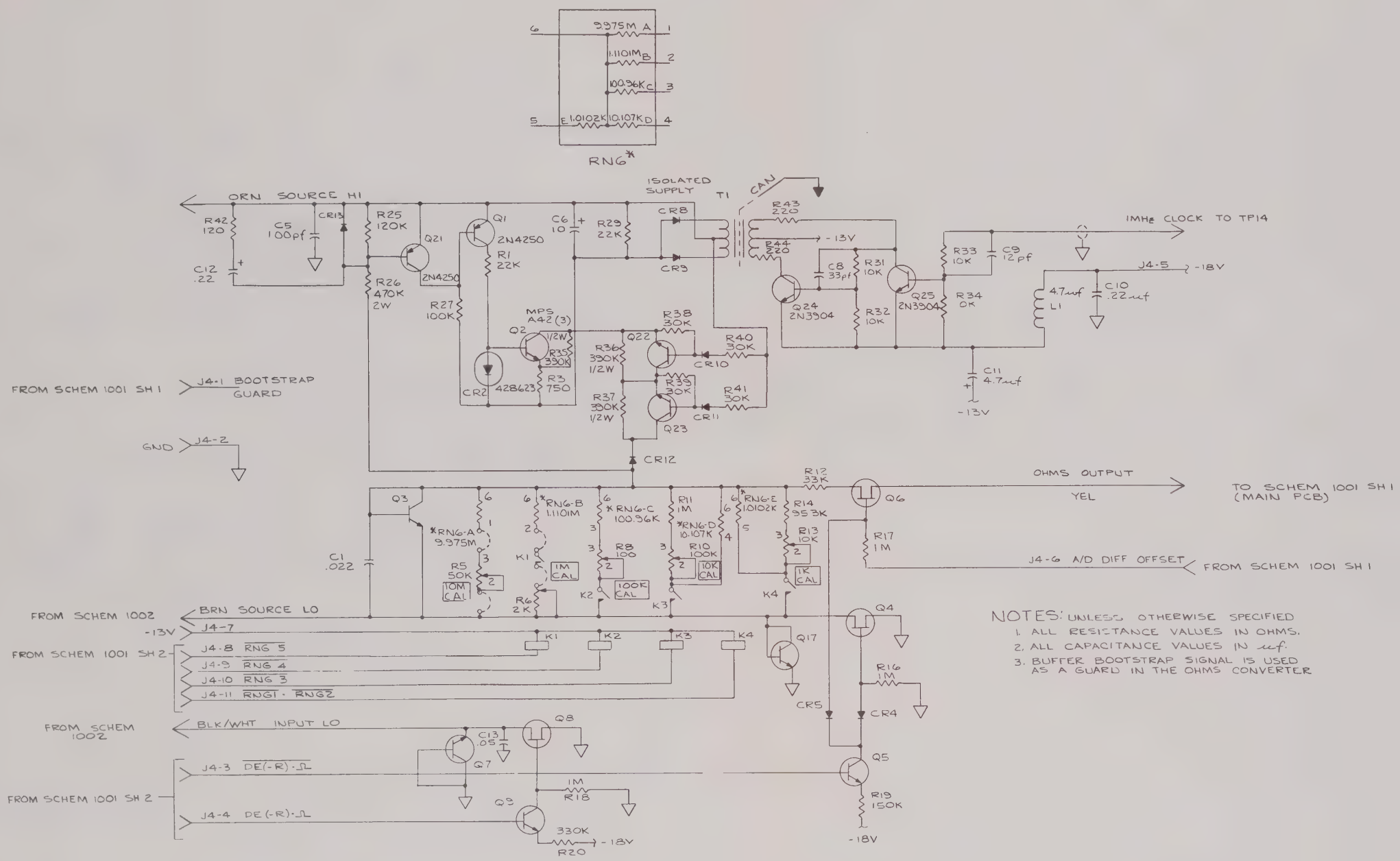
	CATHODE	ANODE
A	1	14
B	13	14
C	10	9
D	8	9
E	7	3
F	2	3
G	11	3
DEC PT	6	3

Figure 8-2. A2A1, DISPLAY PCB ASSEMBLY (cont)



8800A-1610

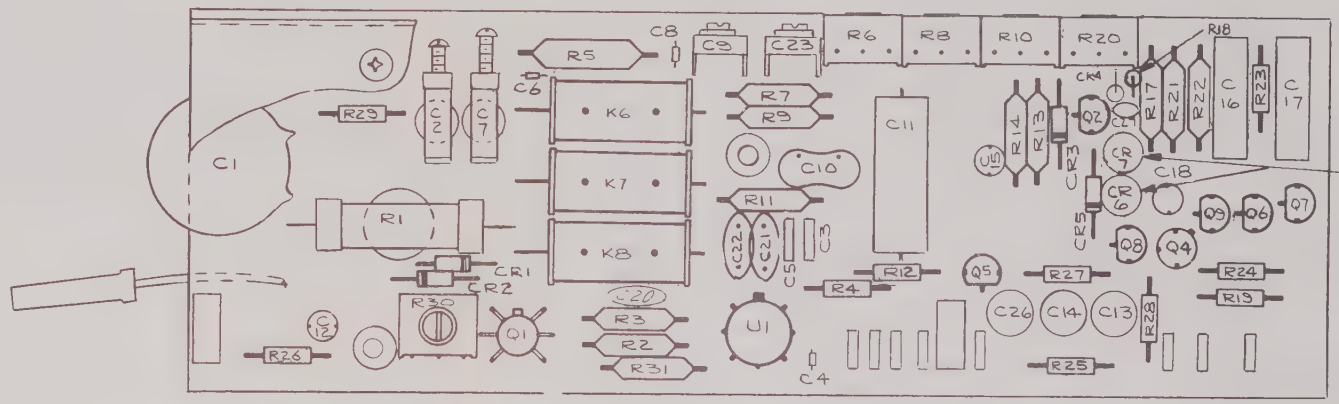
Figure 8-3. A3, OHMS CONVERTER PCB ASSEMBLY

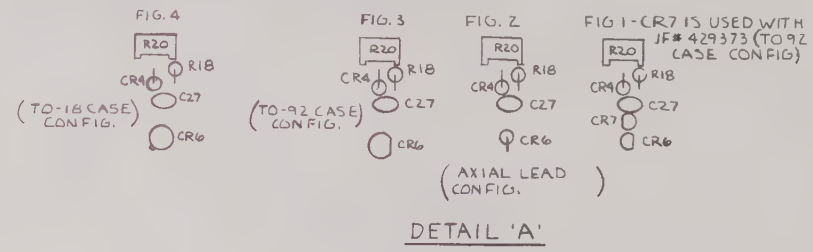


NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCE VALUES IN OHMS.
2. ALL CAPACITANCE VALUES IN uf.
3. BUFFER BOOTSTRAP SIGNAL IS USED AS A GUARD IN THE OHMS CONVERTER

8800A-1010

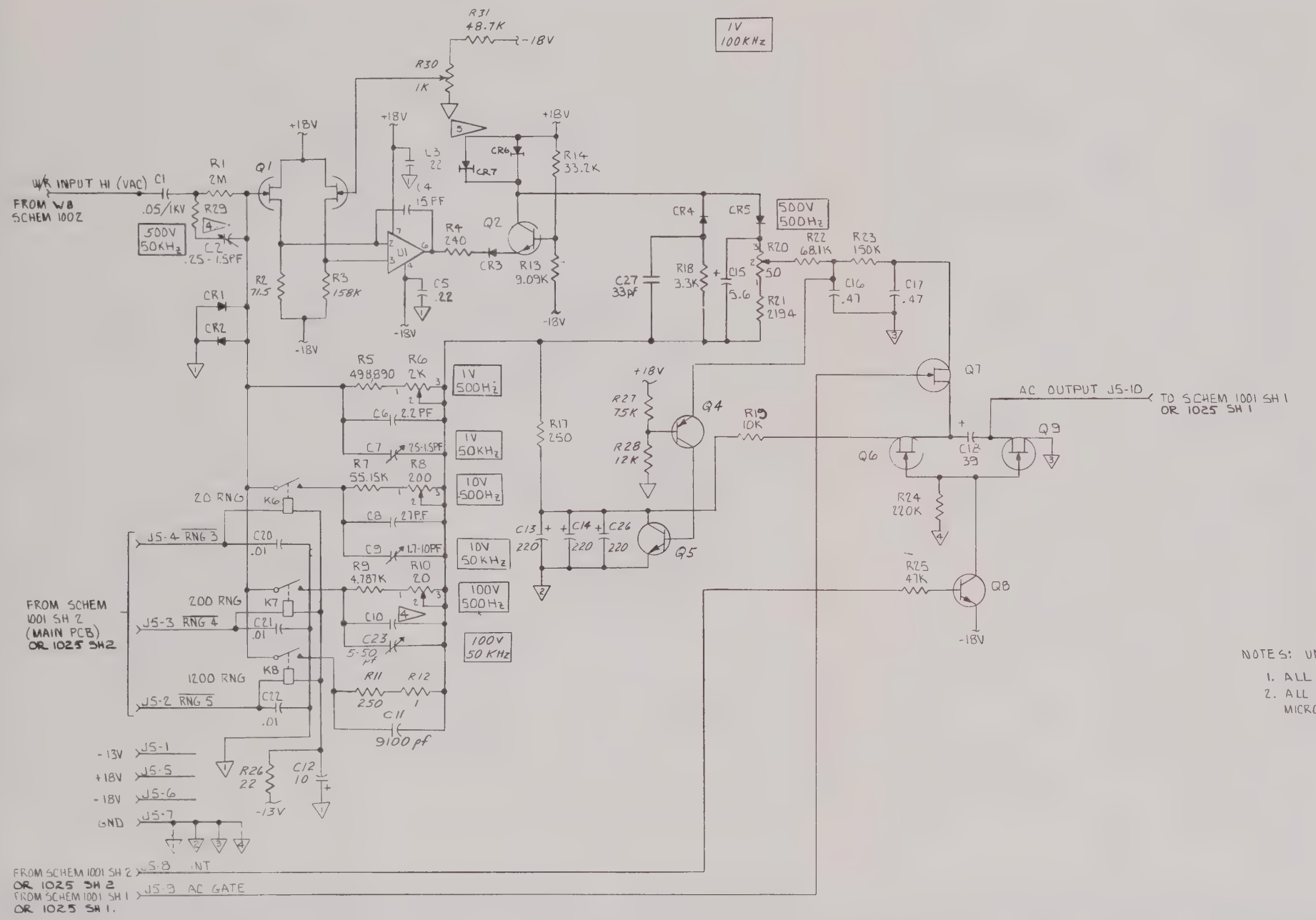
Figure 8-3. A3, OHMS CONVERTER PCB ASSEMBLY (cont)





8800A-1614

Figure 8-4. A4, AC CONVERTER PCB ASSEMBLY

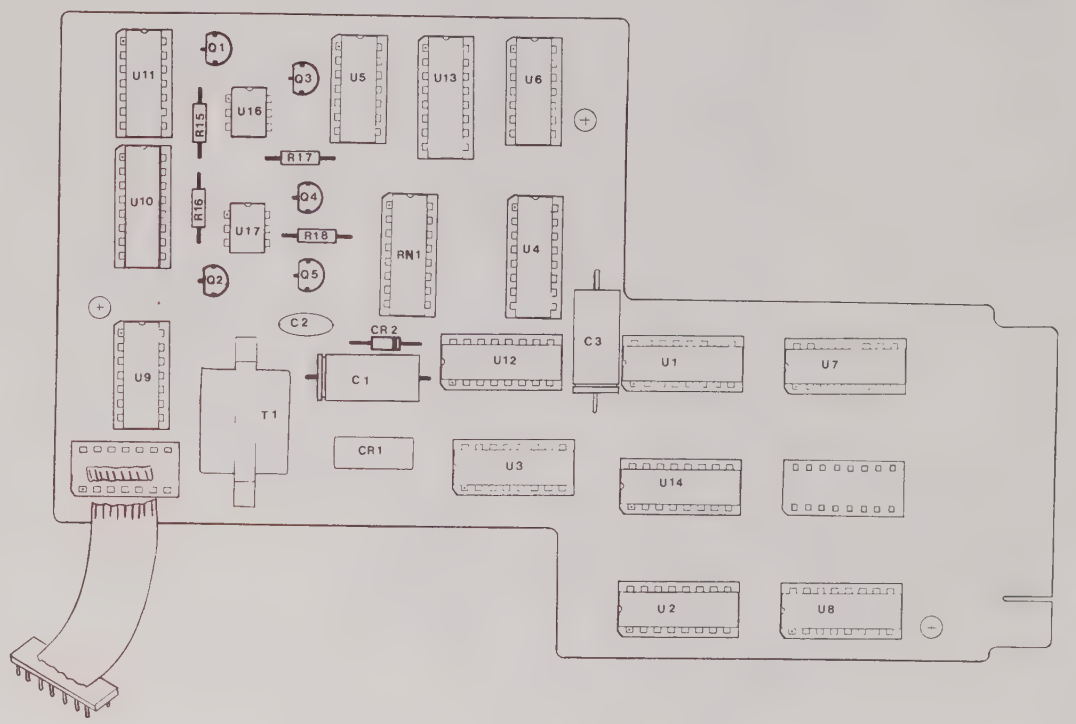


NOTES: UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS,
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.

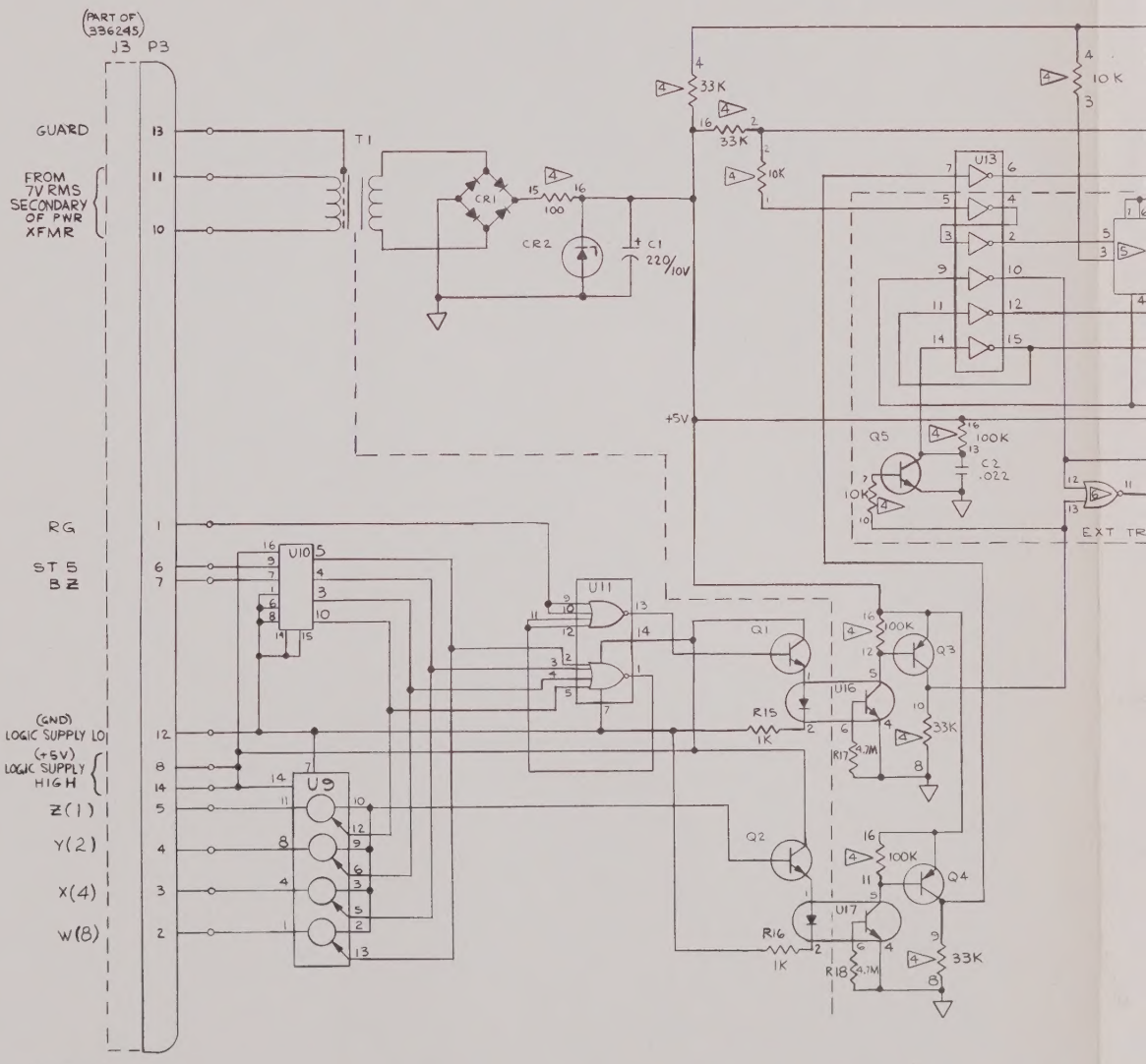
8800A-1014

Figure 8-4. A4, AC CONVERTER PCB ASSEMBLY (cont)



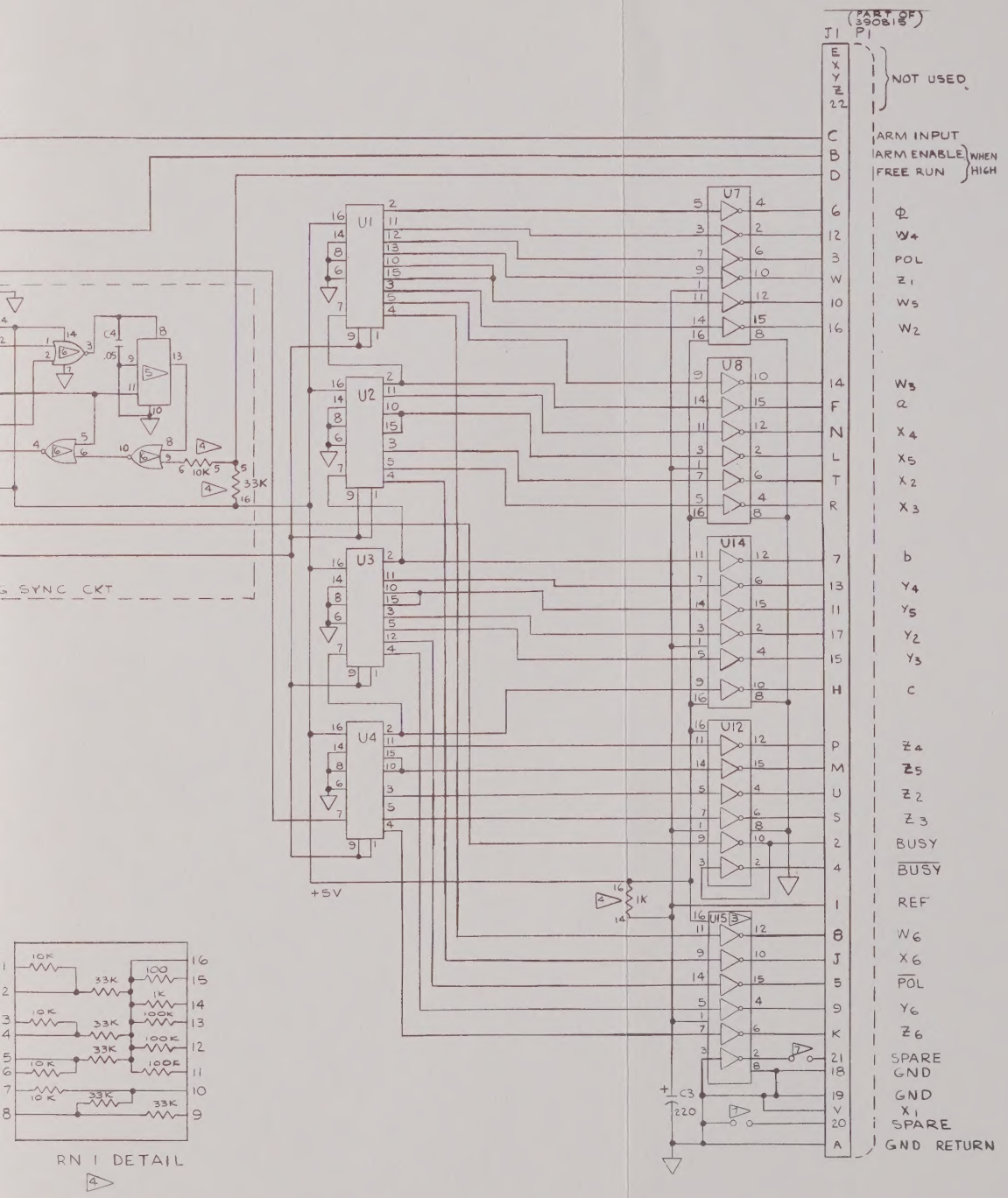
8800A-1205

Figure 8-5. DATA OUTPUT UNIT PCB ASSEMBLY
(OPTION -02)



NOTES:
UNLESS OTHERWISE SPECIFIED;
1. ALL RESISTANCE VALUES IN OHMS, TOL ± 5%.
2. ALL CAPACITANCE VALUES IN MICROFARADS.

<4> PART OF RN1 (RESISTOR NETWORK
<5> PART OF U5.
<6> PART OF U6.
<7> JUMPER AS REQUIRED



8800A-1005

Figure 8-5. DATA OUTPUT UNIT PCB ASSEMBLY (OPTION -02) (cont)